THE REDTAIL SITE:
A MCKEAN HABITATION IN
SOUTH CENTRAL SASKATCHEWAN

A Thesis
Submitted to the Faculty of Graduate Studies and Research
in Partial Fulfillment of the Requirements
For the Degree of
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in the Department of Anthropology and Archaeology

by
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ABSTRACT

There is a problem in classifying McKean. McKean is known as a variable material culture grouping that spans the Plains. It existed from about 5700 to 3300 years ago (or 5000 to 3000 radiocarbon years B.P.). Variation within McKean is assessed. This is based on the analysis of the Redtail site and systematic comparisons with the Cactus Flower and Crown sites. These, and other general comparisons, indicate that McKean can be considered a tradition, as defined by Willey and Phillips (1958: 37). Syms's (1977: 70-72) taxonomic framework is recommended to distinguish an earlier McKean configuration from a later Hanna configuration. Also, based on varying emphasis of use of plant resources, northern and southern regional composites should be recognized within both configurations.

The focus of this study is the Redtail Site (FbNp-10). It is a multicomponent habitation located in a small basin of the South Saskatchewan River in Wanuskewin Heritage Park. This is about three kilometers north of the city of Saskatoon, in south central Saskatchewan. Preliminary tests by Dr. E. G. Walker in 1982 started an ongoing research project. A 44 m^2 block area was excavated at the Redtail site during 1988 and 1989. This fieldwork provides most of the data for this thesis.

The Redtail site's natural strata are complex accumulations of slopewash, colluvial and fluvial sediments. Cultural stratigraphic interpretations are based on the field excavation done in natural layers, point provenience measurements, and backplotting to detailed profiles. Paleosurface maps of the block area and taphonomic data are used to assess the post-depositional modifications. Features and spatial distribution patterns indicate probable habitation structures in some of the layers. This work provides new information for evaluating variation within McKean.

ACKNOWLEDGEMENTS

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Donalee Deck analyzed the flotation samples and provided background information. D. Deck acknowledges M. Kapinga who identified and verified the majority of the seed remains and A.K. Peach who identified the diagnostic faunal remains. Dr. C.T. Shay also provided access to reference materials for the flotation analysis. Billy Ferris modified a version of the RaftTaxa cataloguing program and helped transfer the data to Macintosh. Peggy McKeand and Terry. Gibson allowed me to use their faunal analyses program. Terry and Jane Gibson also spent a tedious afternoon videotaping a cm by cm tour of the Redtail site stratigraphy. Leslie Amundson arranged the particle-size analysis and provided some background information.

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CHAPTER 1

Introduction

1.1) Introduction

McKean is an archaeological grouping distributed across the Great Plains. It is known to span from about 5000 to 3000 radiocarbon years before present (rcy B.P.). This study is concerned with patterns and variation within McKean through this time span, with particular emphasis on the Redtail site and the surrounding study area. A summary is provided of the developments in Great Plains McKean research. This includes a time-area synopsis to provide a broader framework for the local and subregional approach taken in this study. Overall, this work provides a much needed locally oriented perspective of McKean and reviews the problematic internal variation.

The Redtail site (FbNp-10) is presented as additional information that may be used to better understand McKean in south central Saskatchewan. It is a multicomponent site which contains cultural materials ranging in age from recent historic times to over 5000 rcy old. Layers 11 through 13 contain artifacts diagnostic to McKean and radiocarbon dates from these layers span about 3500 to 4300 rcy B.P.

The Redtail site is located at 52° 13′ 8″ N. Latitude and 106° 35′ 5″ W. Longitude. This is about three km north and one km east of Saskatoon in south central Saskatchewan (Figure 1.1). The site is situated in the southeastern corner of Wanuskewin Heritage Park within a small basin that extends about 300 metres back from the edge of the South Saskatchewan River (Figure 1.2). The bottom portion of this basin is approximately 900 m^2 in area. This flatter area has a high potential for precontact habitation. It may also have provided a small trap area for ambushing animals coming to water at the river. Thus, an excavation block was placed in this area adjacent to the main spring-fed run-off channel (Figure

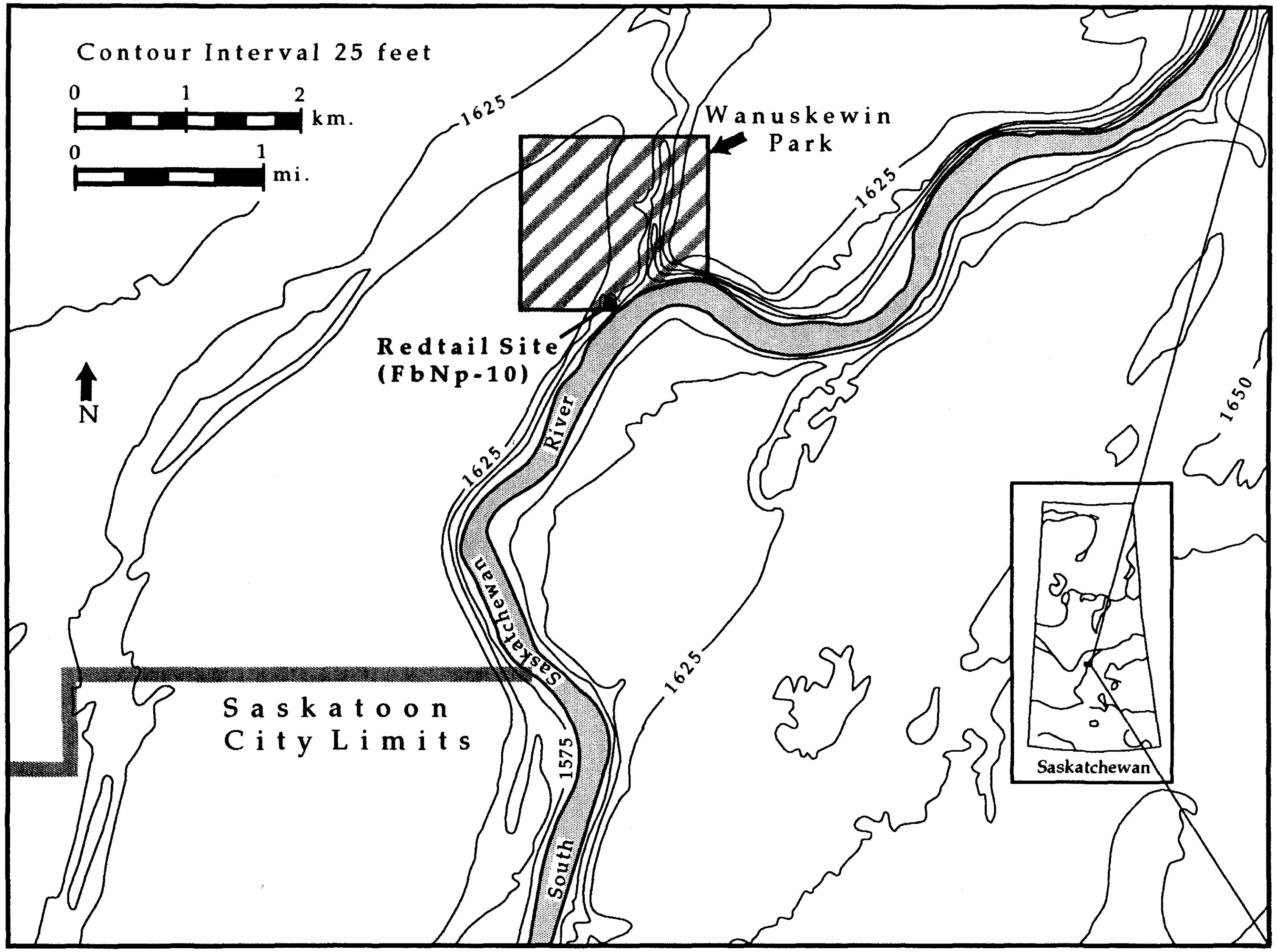

Figure 1.1 Redtail Site (FbNp-10) General Location

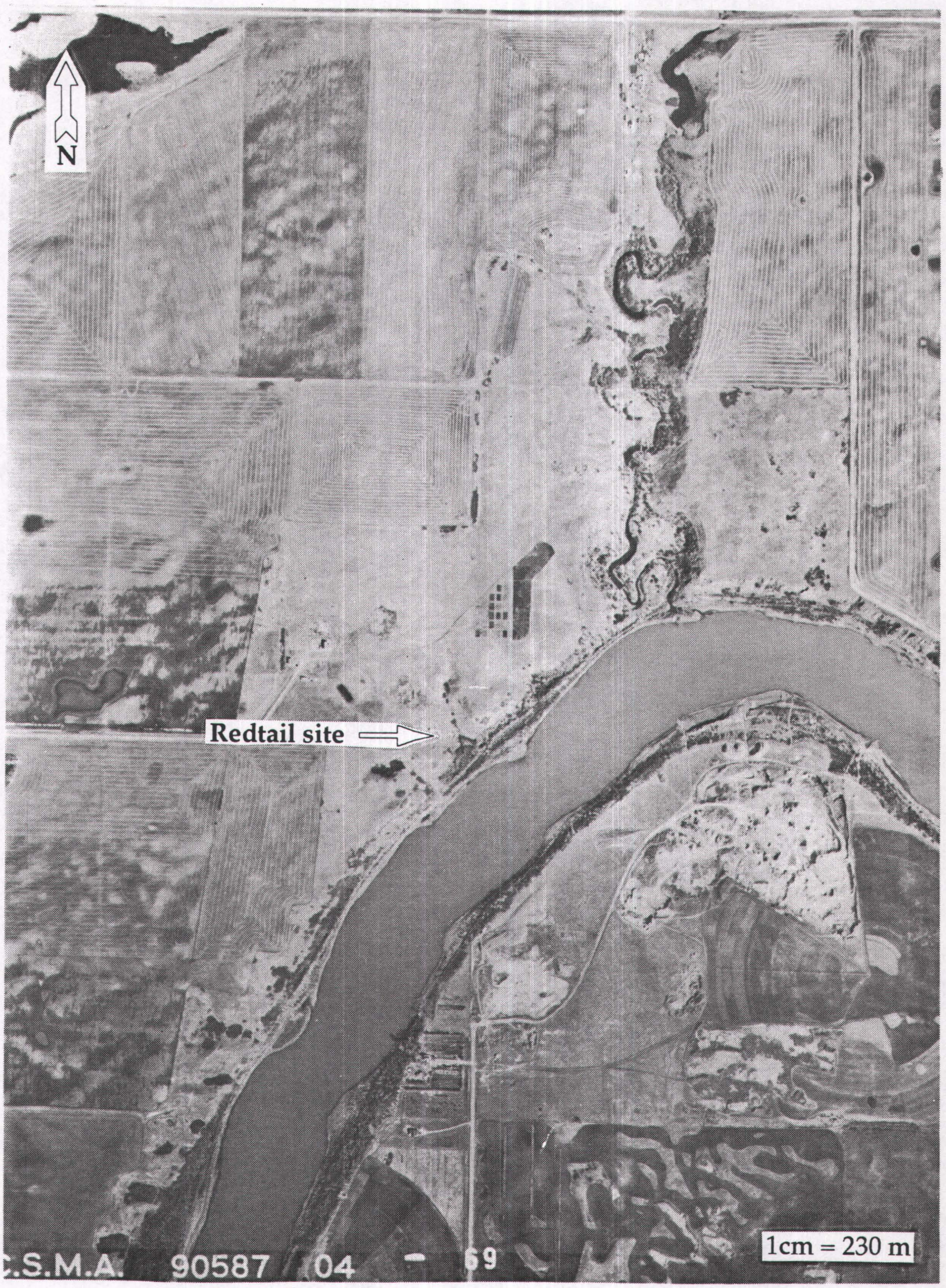

Figure 1.2 Aerial Photograph of the Redtail site (FbNp-10) area in 1990

1.3). Seventy-seven cubic metres were excavated from the block in the 1988 and 1989 field seasons.

1.2) Site Discovery, Assessment and Excavation

The Redtail site was probably discovered originally by collectors during the 1930s and 1940s. Boyd and Dorothy Wettlaufer's (Wettlaufer 1951: 27-35) survey of Saskatchewan collections in 1951 recorded several sites that H. K. Cronk had discovered in the Saskatoon area. Cronk was familiar with the Tipperary Creek (FbNp-1), Tipperary Medicine Wheel (FbNp-2) and Sunburn Tipi Ring (FbNp-7) sites. He also referred to a ravine near the latter two sites which "has a collection of old buffalo bones believed to be a 'winter-kill'" (Wettlaufer 1951: 35). This may be the Redtail site that he referred to, because bone is presently eroding out of the main run-off channel and the Redtail site is within a few hundred metres of these latter two sites.

Michael Vitkowski was the landowner of this area, now known as Wanuskewin Heritage Park, from 1934 to the early 1980s (Walker 1983: 40). He endeavored to protect the many archaeological sites from vandalization, and would on occasion enlighten interested children about the sites. In 1959, Thomas Kehoe was appointed Saskatchewan's provincial archaeologist at the Museum of Natural History in Regina. He visited sites within the area of the present Wanuskewin Heritage Park in the early 1960s accompanied by members of the Saskatoon Archaeological Society (Walker 1983: 11). Kehoe test-excavated the central cairn of the Tipperary Creek Medicine Wheel during this time (Walker *et al.* 1987: 2). In 1965, Dr. Zenon Pohorecky began teaching in the Department of Anthropology and Archaeology at the University of Saskatchewan. At this time Dr. Pohorecky carried out test excavations near the mouth of the Tipperary Creek with the help of students (Walker 1983:11). Alice and Thomas Kehoe (1979: 23, 25 and 28) briefly reported on the Tipperary Medicine Wheel (FbNp-2) in their

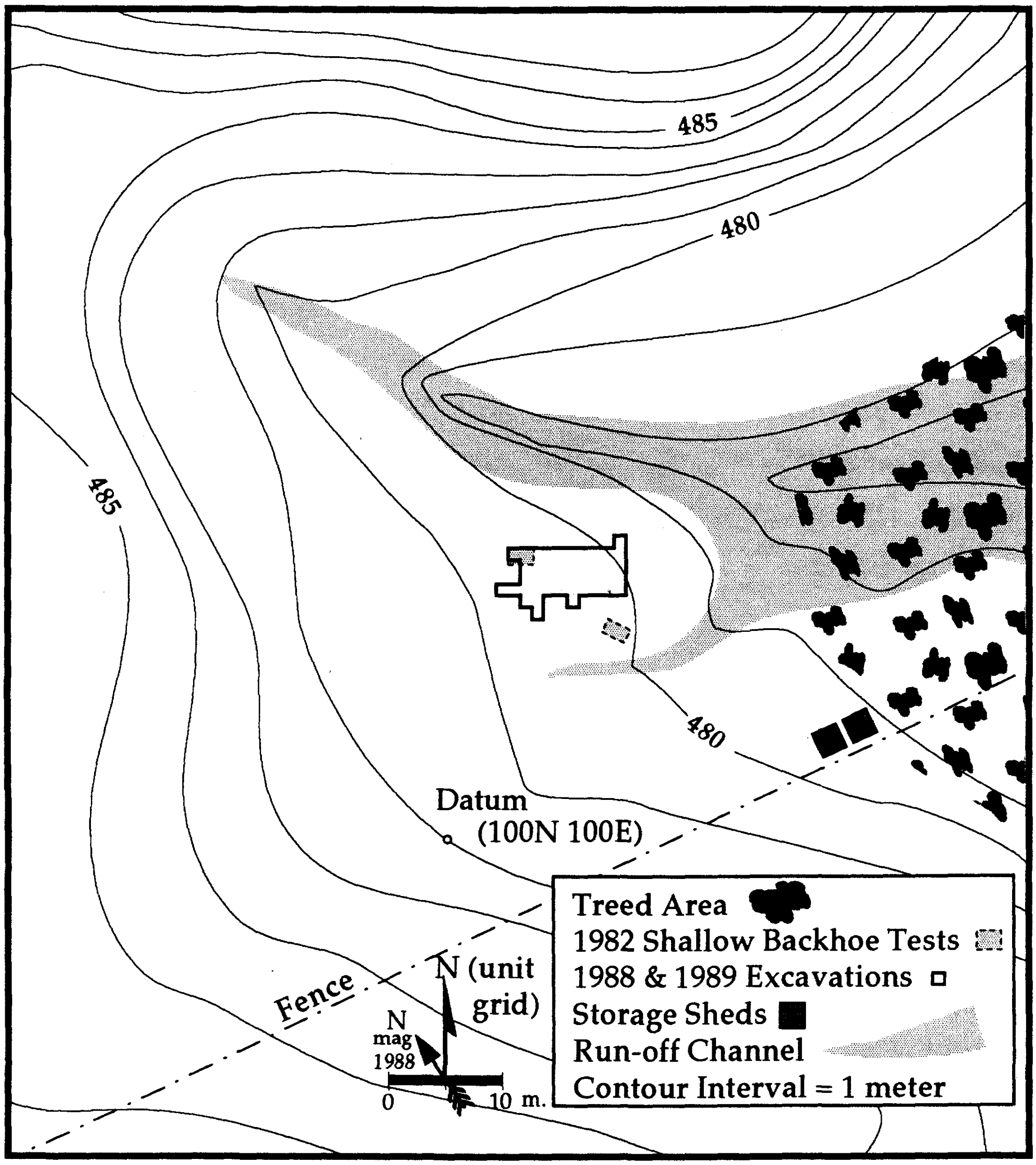

Figure 1.3 Redtail Site (FbNp-10) Basin Area and Excavations

1975 survey of boulder configurations. They mentioned that stone circles were *not* noticed near the Tipperary Medicine Wheel even though the Sunburn Tipi Ring site (FbNp-7) is nearby (Walker 1983:40). These studies apparently did not recognize the Redtail site (FbNp-10), and it was not rediscovered until 1982 when Walker (1983) undertook an archaeological resource assessment of Wanuskewin Heritage Park. At this time 19 sites were identified within the park boundaries. A few other sites in adjacent areas were recorded with further work in this area. The park is presently recognized as a complex of continuous precontact and contact occupations spanning from at least 5340 $\pm$120 rcy B.P. (Amundson 1986: 50).

The 1982 assessment of the Redtail site included three subsurface tests in addition to a general surface collection. The first test was a profile excavation of the main channel's southwest bank. This test revealed "the presence of archaeological materials which obviously had been disturbed by stream action" (Walker 1983: 49). Two other subsurface tests were carried out on the basin's adjacent flat area (Figure 1.4). A backhoe was employed to dig these other tests (Walker, personal communication 1988). Both were about 1.2 m by 2.3 m in size and extended about 20 cm to 30 cm deep (Ramsay 1989: 4). Initial observations concluded that at least two occupation levels existed and that the lower of these contained an Avonlea projectile point (Walker 1983: 49-58). Two other point fragments also appeared to be Avonlea-like (see photos in Walker 1983: 58). A basin-shaped hearth feature was exposed in the profile of the first occupation level. Most bone recovered was unidentifiable fragments. The few identifiable bone materials included bison specimens except for a left calcaneus identified as pronghorn from level 2 in test pit 3. The 1982 assessments concluded that the Redtail site was a multicomponent habitation area (Walker 1983: 49-58).

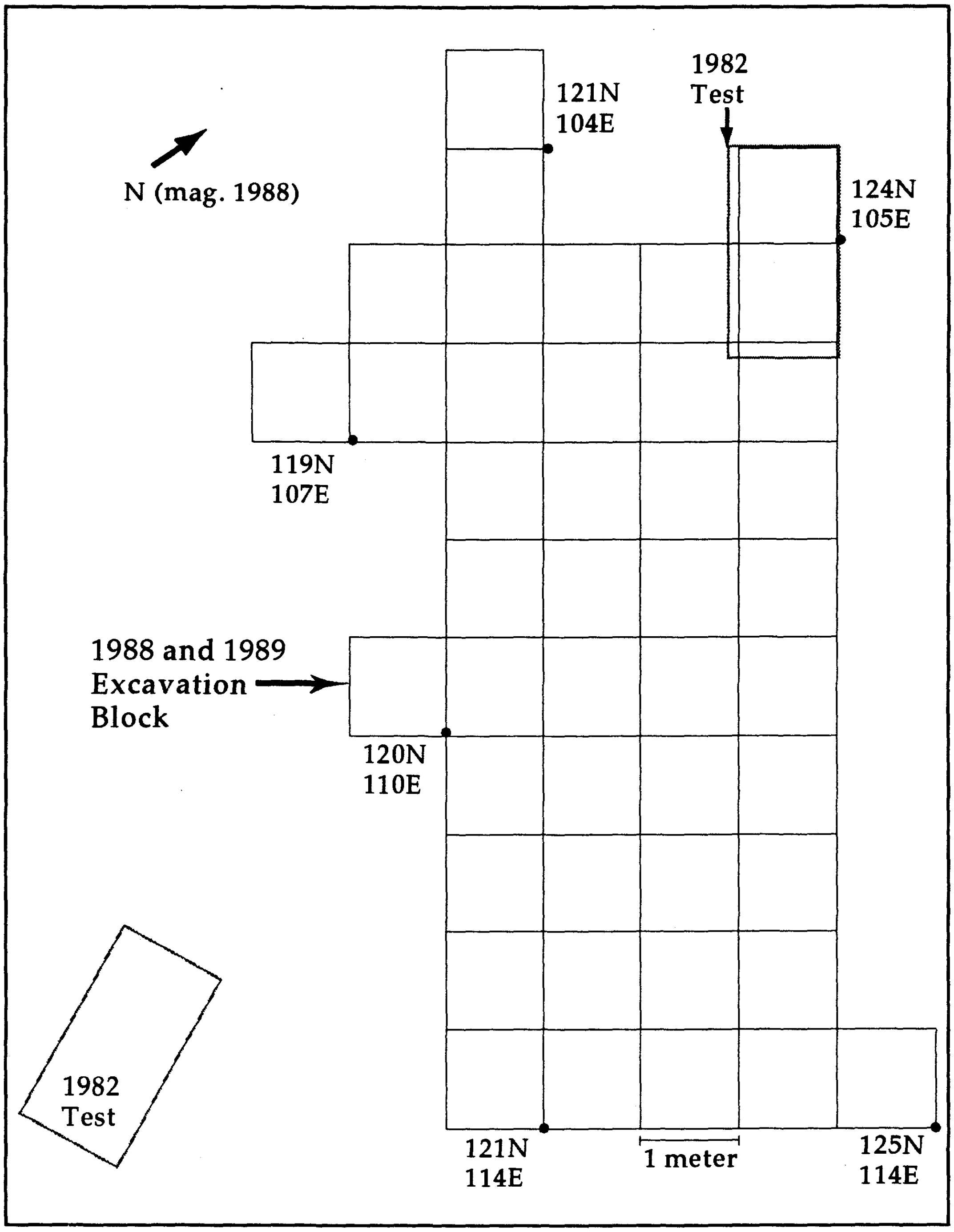

Figure 1.4 Redtail Site (FbNp-10) Excavation Block

Three other sites in Wanuskewin Heritage Park are substantially excavated. Two of these have occupations between 3000 and 5000 rcy B.P. In 1984 and 1985 excavations were undertaken at two sites: Newo Asiniak (FbNp-16) and Amisk (FbNp-17). Newo Asiniak is primarily a Late Precontact* period kill and processing site (Kelly 1986). The processing area also contains some older occupations. Layer six produced a date of 4320 ±85 rcy B.P. (S-2532) (Kelly 1986: 167). There were problems with radiocarbon dates from the lower occupations at this site; however, levels 4 to 7 were identified as Middle Precontact period occupations. Unfortunately, levels 5 to 7 were devoid of diagnostic stone tools (Kelly 1986).

The Amisk site is a multicomponent habitation with the deepest level 7 associated with a date of 5340 ±120 rcy B.P. (S-2768) (Amundson 1986: 50). Levels 2 to 7 all date over 3000 rcy B.P. and overlap with this study's time parameters (Amundson 1986: 50-52). However, no McKean diagnostic items were recovered from these occupations. The Tipperary Creek site (FbNp-1) was excavated between 1985 and 1986. Its lowest cultural occupation layer 13 is associated with a date of 1505 ±75 rcy B.P. (S-2885) (Walker *et al.* 1987: 38). Thus, this site's occupations are too recent for this study.

Excavation of the block began at the Redtail site in the spring of 1988. This was initiated as part of the University of Saskatchewan's Anthropology 260.3 archaeology field class. Dr. Walker, instructing the class, indicated the excavation grid be aligned parallel with the main channel to incorporate the 1982 test unit 2 (Figure 1.3). Fifteen students were supervised by myself and Suzi Zurburg between May 17 and June 2, 1988. A crew was employed from July 6 to August 20, 1988. Nineteen 1 m^2 units (about 38 m^3 of soil) were excavated

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* Note that the term Precontact is used throughout this study in place of the commonly used term Prehistoric. This acknowledges the First People's preferred usage.

during this season with over 50 people volunteering throughout the summer. Over 30 of these came during a "Volunteer Week" for the Saskatoon Archaeological Society (Figure 1.5).

The general excavation strategy was to remove a block area in order to reveal living floor patterns. This was difficult to do with so many people rubbing elbows in a field school. Thus, most units were initially separated or linked diagonally. Intervening units were excavated once the field school was completed.

The 1989 field season began in the spring, again with the Anthropology 260.3 archaeology field class. Intervening units were removed to produce an E-shaped trench network. This provided a better basis for excavation of natural layers, as they were exposed on at least two sides. A field crew continued excavations in June, July and August of 1989. No "Volunteer Week" was held in this second season because of the limited space for people to work in the remaining units of the block. The second season provided rather interesting excavation approaches as, near the end of the season, a few units were excavated from all four sides! A total of 44 m^2 units produced a 4 m by 9 m block with additional units extending upslope and across the slope (Figure 1.6). This block encompassed about 77 m^3 of soil.

Fine-screen sampling was a major part of the excavations in both seasons. In 1988, the northeast quadrant of each unit was fine-screened for every natural layer, with some subdivision into 5 cm or 10 cm arbitrary layers. In 1989, both southwest and northeast quadrants of each unit were sampled for layers 8 to 14. This sampling strategy change was made to focus on the occupation layers associated with the culture material and timespan of McKean. Features encountered were mapped and soil samples were taken for flotation analysis. Funding limitations allowed only a sample of six features to be analysed.

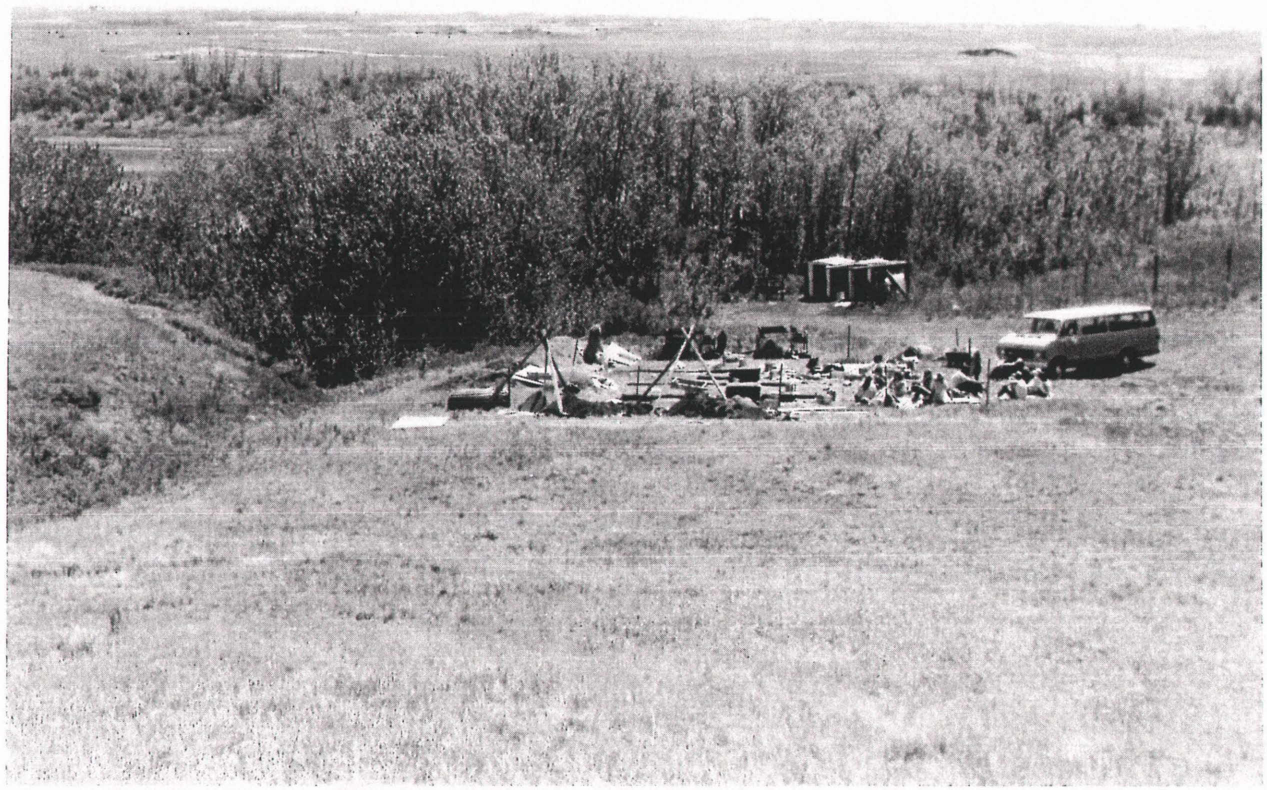


Figure 1.5 Volunteers and crew at the Redtail site (FbNp-10), view facing southeast

Figure 1.6 The completed Redtail site (FbNp-10) block in 1989, view facing west

However, to the best of this author's knowledge, this small sample is important because it is the only flotation data presently analysed for McKean occupations in Canada. No diagnostic items were recovered from layers immediately above and below the McKean occupations recognized in layers 11, 12 and 13. Layers 8, 9, 10, 14 and 15 have been included in the analyses to relatively compare and contrast the local variation of material culture over the entire timespan of McKean on the Plains. This materialistic and diachronic study can then be employed to assess the variation between these layers. It may also assess the variation of the Redtail site's use over this timespan.

1.3) Research Objectives

Six goals have been defined through specific research on the Redtail site materials and in comparative analyses. Four of these are directly related to analyses and interpretations of the Redtail site. Two addition objectives compare the Redtail site to other sites. A contextually oriented comparison will be primarily limited to other sites in the study area. A chronologically oriented comparison will be made to other McKean components from across the Plains.

The first goal will be to describe the Redtail site's layers 8 to 15 and their associated material culture. This will provide information towards understanding the precontact cultures associated with the 3000 to 5000 rcy timespan at this site.

A second goal will be to interpret the subsistence, seasonality, duration of occupation and frequency of each occupation. This can provide valuable comparative information for proposing seasonal movements and resource exploitation.

Third, it will be important to identify activities within the Redtail site's occupations to understand what occurred at the site during different times. Such interpretations will be sought through planviews, distribution maps and artifact indices. General and specific analogies will be drawn from ethnographic, experimental and ethnoarchaeological studies.

The fourth general objective will be to assess the cultural materials and patterns in the Redtail site's layers 8 to 15 to identify the cultural groups represented. This follows the traditional goal of placing occupations within the Plains culture-chronology framework.

A fifth objective will involve comparison of the Redtail site occupations with other sites. The goal will be to assess contextual variation and patterns within McKean for the study area as defined in Chapter 2, focused on the Saskatchewan River systems. This analysis will focus on the only stratified McKean occupations excavated in this study area. These are the Cactus Flower (EbOp-16), Crown (FhNa-86) and Redtail sites (FbNp-10). Some other sites and collections provide a broader perspective in these comparisons.

This research will provide some basis for assessment of variation within McKean. It may provide information to indicate whether subgroups can be identified. This has been a continuing problem for most of the 58 years of McKean studies on the Plains.

A sixth goal will involve reviewing a chronometric database for McKean assemblages to generally assess the separation of McKean subgroupings in time and in different subareas across the Plains.

1.4) Discussion

The Redtail site provides new evidence for understanding McKean in south central Saskatchewan. This evidence is compared with other sites in order to establish local contextual (material culture) and chronological patterns. McKean is reexamined for subgroupings and timespans in different areas.

Chapter 2 reviews the general Plains environment and presents a summary of local setting, including paleoenvironmental conditions. Chapter 3 discusses the classification approach taken in this study as well as theoretical concepts used for later interpretations. This chapter also defines McKean and provides some general background on McKean research. Chapter 4 presents the general field methodology, stratigraphy and dating methods used in the Redtail site excavations. It also incorporates some discussion of paleotopographic and taphonomic factors. Chapter 5 describes, analyses and proposes low-level interpretations of artifacts and other cultural material from the Redtail site. Chapter 6 identifies and interprets faunal remains. Chapter 7 presents feature descriptions, and discusses their patterns and flotation analyses. General material distributions are discussed and interpreted in relation to these feature patterns. Chapter 8 compares the Cactus Flower, Crown, and Redtail sites in some detail. These stratified McKean occupations provide a good foundation for other site comparisons. Temporal-spatial aspects are presented for McKean across the Plains in the latter part of Chapter 8. Chapter 9 provides a synthesis of the Redtail site's interpretations and relates general conclusions from the comparative study.

CHAPTER 2

Regional Setting and Environment

2.1) Introduction

The Great Plains has several consistent features, but it also has considerable variation in local physiography and environment. This is important to keep in mind when discussing human adaptation across the Plains. A brief synopsis will include a summary of general Plains characteristics. Definition of the study area along the South Saskatchewan and Saskatchewan River systems will provide a spatial focus for later comparisons. A regionalized description of the modern environment and paleoenvironmental conditions of the study area will follow. This information will place McKean in an approximation of its environmental setting.

2.2) Great Plains Area

The Great Plains of North America is an area of grassland covering about 1,166,000 km^2 (Gilbert 1980b: 8). Its modern boundaries extend roughly from the parkland in Canada's prairie provinces in the north to the mesquite-covered Edwards Plateau in Texas at the southern limits. Its breadth extends from the foothills in the west, including some mountain valley basin systems of Alberta, Montana, Wyoming and Colorado, and eastward to the woodland margins of Manitoba, the Dakotas, Nebraska, Kansas and Oklahoma (Figure 2.1). Over time the boundaries have varied, but these grasslands have existed much as they were until recent historic times, at least since about 8000 years ago (Bryson, Baerreis and Wendland 1970). These boundaries are comparable to those defined by Lowie (1985: 1-12) and Gilbert (1980b: 8-15).

Gilbert (1980b: 8-15) provides a concise summary of the general plains environment and topographic features. He notes that the Great Plains are transected by several mountain glacier-fed river systems. "The generally

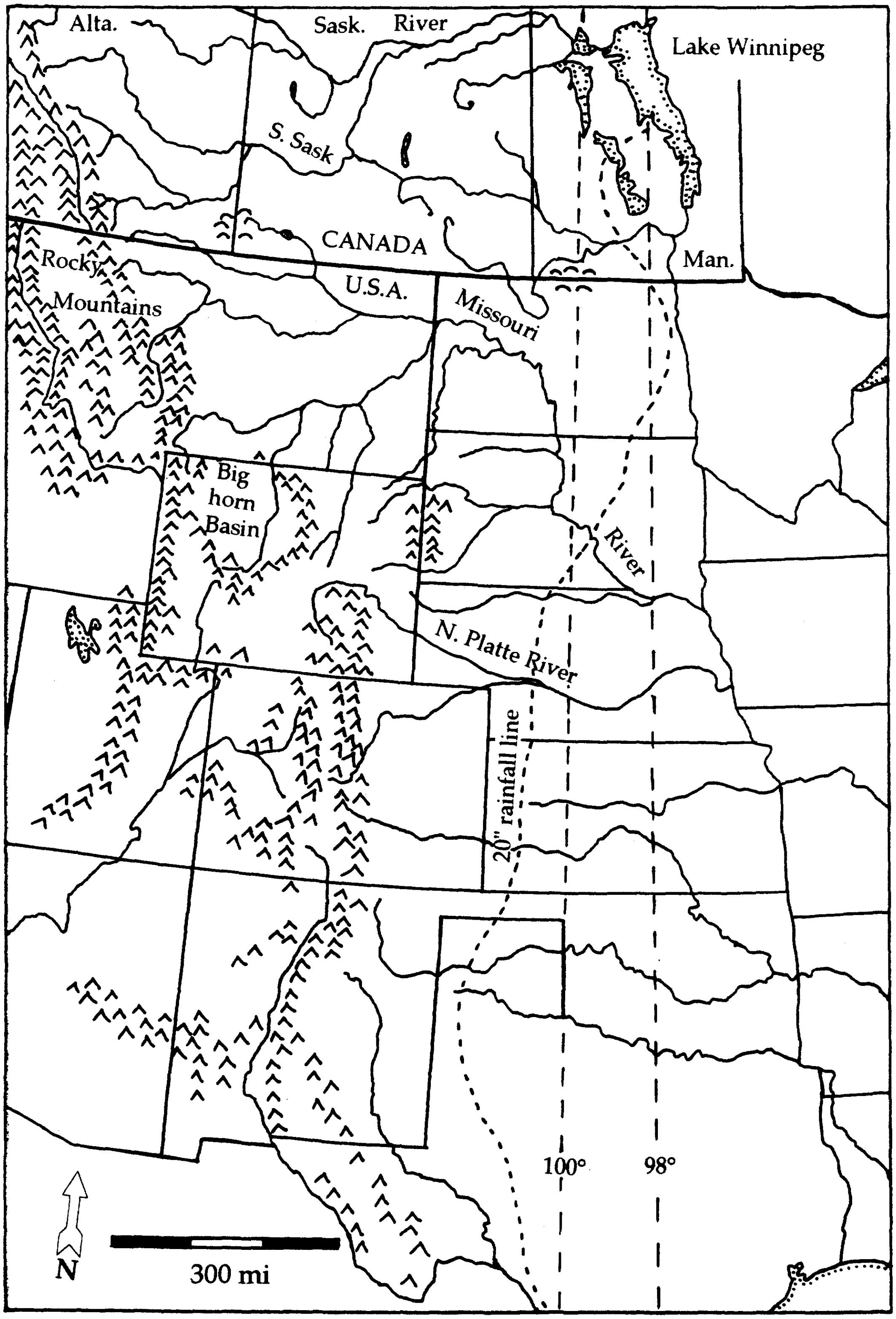


Figure 2.1 The Great Plains area and some of its general features

(From Plowden 1972 in Gilbert 1980b: 9, Figure 1) eastward flowing rivers have gone through repeated cycles of downcutting, deposition, and erosion, which has left badlands, buttes, canyons, escarpments, gullies, mesas, rolling hills, sandhills, terraces, and seemingly endless plains" (Gilbert 1980b: 8). The Northern Plains are dominated by the Missouri Plateau which rises about 305 m above the surrounding tableland. South of this, from southwestern Wyoming into Colorado, Nebraska and Utah, are the outwash sediments from the Rocky Mountains known as the High Plains. Eastern and northern margins of the Great Plains are generally referred to as the lowlands or tall grass prairies. "The combination of generally low and variable precipitation, high evaporation by the seemingly ceaseless wind, and rich deposits of alluvium and loess resulted in the predominantly grassland biome which characterizes the Plains" (Gilbert 1980b: 10-11).

The unifying theme to the Great Plains was the expanses of grasslands that were home to upwards of thirty-two million bison, and at least two million more in areas bordering the plains (McHugh 1972: 16-17). Adaptation to these open, treeless expanses was possible through the use of portable skin-covered tipis or other make-shift dwellings. Most plains groups depended on bison as a major part of their subsistence. Thus, the bison had a major influence on technological adaptations, people's movements, social organization and beliefs (Lowie 1985; Wood and Liberty 1980). People bordering the Plains were known to occasionally, if not regularly, foray into the Plains to hunt bison (Brink 1986; Russell 1991; Turney-High 1937, 1941; Will and Spinden 1906). During the late precontact times there was an extensive trade network which involved bison products such as dried meat, pemmican, hides, horns and other manufactured items (Wood 1980). This trade probably occurred for some time prior to this, as is suggested by the presence of exotic items on the Great Plains such as copper from the Great Lakes or northern regions, shells from the Atlantic coast, and ground stone celts from the Montane region. For example, Oxbow has components dating between 3000 to 5000 rcy B.P that contain shell beads made from *Natica clausa* (a species found along the Atlantic coast). Oxbow components also contain copper ornaments that indicate trade with groups that had access to eastern Great Lake's copper sources or possibly other northern copper sources (see Millar 1978: 330-342; Wormington and Forbis 1965: 113-166, Fig. 45).

Though bison were the dominant animals on the Great Plains, they have been the focus of Plains archaeology so much that other subsistence resources have been grossly underestimated. Other ungulates available in certain areas include antelope, white-tailed deer, mule deer, elk, moose, mountain sheep and mountain goats. Many other mammals available for food, hides or other products included various carnivores (e.g. wolves, dogs, coyotes, foxes, racoons, mustelids, bears, and felids), rodents (e.g. beaver, porcupine, ground squirrels and microtines) and rabbits. Birds were an important food resource at certain times of the year, but also provided hollow bones for beads, claws and feathers for clothing adornment and other uses. Some other animal resources used for food, tools or symbolic motifs included fish, reptiles (e.g. snakes and turtles), amphibians (e.g. frogs, toads, and salamanders) and insects (e.g. crickets in the Big Horn Basin) (see Banfield 1987; Frison 1991: 8-14; Frison and Huseas 1968; Gilbert 1980a; Lowie 1985: 13-29).

A great array of plant resources was also seasonally available and included berries (e.g. saskatoons, chokecherry, pincherry, gooseberry, cactus berries and rose hips), roots (e.g. some camas, prairie turnips, prairie onions and cat-tail), seeds (e.g. chenopodium and wild rice), and leaves or stalks of plants (e.g. yucca). Other plants domesticated in precontact times on the Plains included tobacco, maize and possibly varieties of beans and sunflowers. During contact times berries and hazelnuts formed an important part of the diet of Plains Cree and Assiniboin.in the area (Mandelbaum 1979: 74-79). For an extended list of plants used by Plains groups see Gilmore (1919), Craighead, Craighead and Davis (1963), Harrington (1972) and Helleson and Gad (1974). Woody plants provided material for many tools, and frames for structures (e.g. pine, willow, aspen, and others), and other plants (e.g. nettles) could provide fibers for making string or cord (Lowie 1985: 59-63). Fuel for fires was provided by dried bison dung in the open areas devoid of trees.

2.3) Regional and Local Environment

2.3.1) Modern Geographical Setting

The present environment is not significantly different from the paleoenvironmental conditions between 5000 and 3000 rcy B.P. and provides a general basis for understanding local and regional adaptations. The "study area" used for more detailed site comparisons is defined by the South Saskatchewan and Saskatchewan River systems. An arbitrary southwestern limit is denoted by the Cactus Flower site and a northeastern limit is associated with the Nipawin region. Some additional comparisons are made with a few other sites in southern Saskatchewan. This study area includes portions of the Great Plains and the Central Lowlands physiographic provinces. The Saskatchewan Great Plains physiographic province is divided into the Uplands and Plains areas of the Alberta Plateau region. The Central Lowlands physiographic province contains the Saskatchewan Plains region which is within the study area. In this Saskatchewan Plains region there are subdivisions of the Saskatchewan River Lowlands, the Central Saskatchewan Plains and the associated Uplands (see Richards 1969: 40-41).

The general climate of southern Saskatchewan is defined by Chakravarti (1969: 60) as a cold steppe climate, coinciding with the grassland area of the south and as a cold "Forest" Climate corresponding with the aspen grove and mixedwood forest areas. In short,

> Saskatchewan experiences a cold continental climate but due to a large latitudinal expanse considerable variations in the climatic conditions occur from one place to another. . . . [Many] areal variations are the result of relief differences. Features such as the Cypress Hills, Porcupine Hills, the deeply incised river valleys, low lying areas and lakes greatly modify the distribution patterns of temperature, precipitation, wind velocity and other elements of the climate (Chakravarti 1969: 60).

A discussion of the bedrock and surficial geology may be useful to understand the general availability of lithic material types for stone tool technology. Southern Saskatchewan is primarily dominated by Cretaceous sandstones, siltstones and shales. In the extreme south, however, Tertiary formations exist around the Swift Current, Shaunavon, Eastend, Cypress Hills locales and also south of Assiniboia, Weyburn and Moosomin, in the Big Muddy and Souris River drainage basins. These formations contain other varieties of shales and siltstones (see Byres *et al.* 1969: 44-47).

The Pleistocene continental glaciations are responsible for much of the present landscape in Saskatchewan. Glacial drift deposited during the last Wisconsin glaciation was the primary contributor in shaping the present topography (Kupsch 1969: 48-51). "Drift can be divided into two distinct but gradational groups of material: till laid down by glacier ice, and stratified drift laid down by water" (Kupsch 1969: 48). Glacial till has provided a variety of other lithic materials including silicified sedimentary, igneous and metamorphic rocks. These were transported by glaciers from Saskatchewan's more northern areas. Some quartzites may also have been transported from the west by fluvial processes (Vonhof 1969 in Johnson 1986: 66). There are also other sedimentary and partially metamorphosed rocks redeposited by glacial-fluvial processes. These lithic resources have been utilized by all of the precontact occupants of southern Saskatchewan (see Johnson 1986). McKean is certainly no exception and, in fact, archaeological work in Alberta, Saskatchewan and Manitoba indicates that McKean components contain almost exclusively local lithic materials (Brumley 1975: 72; Quigg 1986: 101; Syms 1969: 175).

Sand hill complexes, prairie sloughs, uplands and the river drainage systems that developed at the conclusion of the Wisconsin glaciation have existed much as they are today with relatively minor modifications over the last 10,000 years. This has provided a differentiated landscape supplemented by a variety of transitional ecotones between forest, parkland, prairie and plains. There are three main ecodistrict groupings that are relevant in this study. These include the Mixedwood-Parkland Transition, Parkland / Aspen Grove and Grassland Prairie Ecoregions (Harris *et al.* 1983: 4-5).

The Parkland Ecoregion has a total annual precipitation of 410 mm in the Aspen Grove Ecodistrict and slightly higher in the more eastern Aspen-Bur Oak Ecodistrict at 430 mm. The Grassland Ecoregion's total annual precipitation is 375 mm in the Mixedgrass Prairie and considerably less in the Sandhill complexes (about 330 mm) and Shortgrass Prairies (about 310 mm).

The mean temperature ranges for the month of January are -20° C in the Mixedwood-Parkland Transition, -19.2° C in the Aspen Grove, -16.9° C in the Mixedgrass Prairie, -14° C in the Sandhill complexes, - 14.5° C in the Shortgrass Prairie and -11.3° C in the Cypress Hills. The mean July temperature is 17° C in the Mixedwood-Parkland Transition, 18°C in the Aspen Grove, 18.7° C in the Mixedgrass Prairie , 19.2° C in the Sandhill complexes, 19.1° C in the Shortgrass Prairie, and 17.1° C in the Cypress Hills (Harris *et al.* 1983).

Mixedwood-Parkland Transition Ecodistrict:

The Mixedwood-Parkland Transition Ecodistrict is mainly an undulating to rolling morainic plain and includes the upland area of the Thickwood Hills.

The predominance of Dark Gray Chernozemic Soils indicates that this "ecodistrict was likely occupied at one time by grassland vegetation" (Harris *et al.* 1983: 30). This area is predominantly treed by mixed aspen and white spruce in the chernozemic soil areas. Grasses are more common than farther north and the occasional isolated grasslands which occur are dominated by speargrasses (*Stipa spartea* and *S. comata*), wheat grasses (*Agropyron dasystachyum* and *A. smithii*) and a rough fescue (*Festuca scabrella*). Wildlife includes large diverse populations of moose, white-tailed deer, elk, black bear and some mule deer. Grouse are common and several other bird species are present seasonally. Common fish in lakes and streams include northern pike, walleye, whitefish, some perch and lake trout (Harris *et al.* 1983: 30-32).

Parkland/Aspen Grove Ecodistrict:

The Parkland's Aspen Grove Ecodistrict has a drier, warmer climate with gently undulating to rolling morainic uplands, and some glaciofluvial, glaciolacustrine and aeolian plains. Soils are mainly Black and Dark Gray Chernozems. "The area has lost most of its native vegetation due to cultivation, [although] small aspen woodlots on upland sites and willows on moist and wet sites around sloughs [still] give the landscape a park-like appearance" (Harris *et al.* 1983: 33). Trembling aspen is the dominant tree species in addition to balsam poplar in moist areas, and white birch on better drained areas. "Eastern cottonwood, green ash and Manitoba Maple are common in the river valleys" (Harris *et al.* 1983: 33).

Grasses dominate the understory of aspen. Mainly these include brome grass (*Bromus sp.*) and bluegrass (*Poa sp.*), but also sarsaparilla (*Aralia nudicaulis*) and beaked hazel nut (*Corylus cornuta*) occur. Prairie vegetation includes rough fescue (*Festuca scabrella*), spear grass (*Stipa comata*), and wheatgrass (*Agropyron dasytachyum*). Other common plants include saskatoon (*Amelanchier alnifolia*), wolfwillow (*Elaeagnus commutata*), and pincherry (*Prunus pensylvanica*) (Harris *et al* 1983). Modern fauna includes mostly white-tailed deer, a few elk, and some mule deer (especially along riparian systems). Bird species are common in sloughs and uncultivated areas. Common fish species include the northern pike, walleye and perch (Harris *et al.* 1983).

Grasslands and Mixedgrass Prairie Ecodistricts:

The Grasslands and Mixedgrass Prairie are dry and warm with a level to rolling lacustrine and morainic plain. The predominant Brown and Dark Brown Chernozemic soils maintain a variety of grasses and herbs. Speargrasses (*Stipa comata* and *S. spartea*), wheatgrasses (*Agropyron dasystachyum* and *A. smithii*) and June grass (*Koeleria cristata*) are most characteristic of upland areas. Drier south-facing slopes are in many places dominated by "prairie wool" or low blue grama (*Bouteloua gracilis*) and thread-leaved sedge (*Carex filifolia*). Valleys contain brush patches dominated by willows (*Salix sp.*), saskatoon, chokecherry (*Prunus virginiana*), snowberry (*Symphoricapros occidentalis*) and wolfwillow. The most common herb is probably pasture sage (*Artemesia frigida*). Ungulates in these areas presently include mule deer, white-tailed deer and antelope, though upland areas are frequented by moose and elk (Harris *et al.* 1983).

An inventory of vascular flora within Wanuskewin Heritage Park has been developed with comparisons from ethnobotanical and plant taxonomic references (see Hilderman *et al.* 1986: II-1 to II-12). Hilderman *et al.* (1986: III-1 to III-8) and Hudson (1988: 1-3) also provide an inventory of the avifauna from Wanuskewin Park. Hilderman *et al.* (1986: III-9 to III-12) inventoried the mammals, fish, amphibians and reptiles at the park. These are particularly relevant data for the Redtail site's local environment.

Beck's (1958) guide to Saskatchewan's mammals provides important background information on several species. Locational aspects and descriptions are also presented. This information, coupled with Banfield (1987) and Gilbert (1980a), will be used in the discussions of mammals found at the Redtail site. Godfrey (1986) provides background information for bird species.

2.3.2) Paleoenvironmental Conditions

The preceding summary of the environment for southern Saskatchewan reflects the present conditions. However, McKean peoples adapted to this area between 3000 and 5000 rcy B.P. A major difference at this time was the presence of large bison herds as the major food source on the Great Plains, as noted in the general Plains summary. The Plains buffalo wolf, domestic dogs and Plains grizzly are other larger animals that were present in the precontact Plains environment.

Vance (1987:17-32) has discussed the climatic variations of the Hypsithermal or Holocene thermal maximum in western North America. This warm, dry period generally had a longer growing season and greater aridity, based on a lower aridity index (Mathews 1985; Mathews and Heusser 1981, Vance 1987; Schweger 1987; Zoltai and Vitt 1990). The peak of this warm and dry period varies across the Northern Great Plains, but in this study area it has generally been accepted as between about 7500 and 5000 rcy B.P. (Buchner 1980: 43; Walker 1987, 1992: 11-14). At about 6000 rcy B.P. Zoltai and Vitt (1990: 238) estimate, from their fen studies, that growing degree days were 6% to 20% higher, probably due to a longer growing season and higher summer temperatures. Also, they indicate that precipitation in the Saskatchewan Plains Ecodistrict was about 19% lower which, when combined with higher growing degree days, suggests 17% to 29% greater aridity (Zoltai and Vitt 1990: 238).

"Historic meteorological records reveal two patterns of atmospheric circulation associated with drought periods in the western interior of Canada. One involves a reduced westerly flow, the second an increased westerly flow"

(Vance 1987: 19). With improvement of records for variations of solar radiation, the size and extent of continental glaciers, and sea-surface temperatures it is feasible, combined with an understanding of high altitude winds, to postulate how circulation patterns varied in the past (Vance 1987:19). Vance's (1987) model of Holocene circulation patterns generally corresponds with Mathews and Heusser (1981), Schweger (1987), and Barnosky (1984). He proposes that the maximum Holocene temperatures and minimum precipitation began on the Northern Plains as early as 10,000 years ago and continued until 7500 to 6000 years ago. The period of maximum eastward prairie expansion in the American midwest occurred between 8000 and 7000 years ago (Adam and West 1983 in Vance 1987:27). Lake levels dropped to their minimum levels, indicating the most intense period of Holocene drought in the North American midwest was between 7200 and 6200 years ago (Webb and Bryson 1972 in Vance 1987: 27).

> A continual stream of Pacific air eastward off the Rockies would inhibit cyclogenesis in central Alberta, allowing prairie vegetation to persist north of its present limit. This may account for the continued, but subdued, drought evident in central Alberta from about 6,000 to 4,000 B.P. (Vance *et al.* 1983 in Vance 1987: 29).

Palynological studies in the Nipawin area (Wilson 1982: 288-318) and Prince Albert area (Mott 1972: 1-18) of Saskatchewan support these general views by demonstrating a northward shift in the border between the mixedwood forest and the parkland. Wilson (1982: 297) notes that prior to 4000 years ago the Nipawin area, presently in the mixedwood forest, was located in the parkland belt or perhaps even in grassland. By 2500 to 2200 years ago this area had assumed to approximately the recent precontact vegetation (Wilson 1982:306; Ritchie 1976). Mott's (1972) study had dating problems. However, evidence from an ostracod study done by L.D. Delorme (in Mott 1972: 13) in southern Saskatchewan suggests that the area was arid and drought ridden by 8500 rcy

B.P. Many studies indicate that the response of vegetation to climatic change are slow, especially for tree populations (Brubaker 1986; Prentice 1986; Ritchie 1986; Webb 1986). The animal and cultural adjustments would likely follow these vegetation changes, although there are many other variables to consider. These responses would have continued into the 5000 to 3000 rcy B.P. timespan of this study. This roughly correlates with the Blytt-Sernander Sequences' Sub-Boreal period between about 4680 ±490 rcy B.P. and 2890 ±510 rcy B.P. (Buchner 1980: 59; Wendland 1978)

Generally, Vance (1987: 19) speculates:

> . . . that the early Holocene would be characterized by drier winters and periodic summer drought. In contrast, mid-Holocene summers would tend to have had extended periods of warm and dry conditions accompanied by high winds while winters would be shorter with increased precipitation compared to the early Holocene.

With Wilson's (1982) data it is speculated that prior to 4000 rcy B.P. the Northern Plains could have had warmer and drier summers, with shorter but somewhat snow-laden winters. By 2500 to 2200 rcy B.P. the summers may have become moderate and winters comparatively drier and longer. Prior to 4000 rcy B.P. and probably well after the climate was moderating, the grasslands would have extended farther north. This would have enabled the dominating herds of bison to extend their range or length of occupation over the present parkland areas and beyond. This may have attracted the bison-oriented Plains groups to areas farther north than has been suggested for earlier and later times. Archaeological remains also support the conclusion that McKean had expanded farther northward (e.g. Quigg (1986); Syms (1969); Tamplin (1977)).

2.4) Discussion and Summary

The Great Plains is a diverse grasslands environment, but the common fauna and open expanses have resulted in similarities of cultural adaptations.

The "study area", primarily focused on the South Saskatchewan and Saskatchewan River systems, spans the region from the Cactus Flower site in the southwest to the Nipawin locale in the northeast. Some other relevant sites in southern Saskatchewan are also generally compared.

The environmental overview provides a context for the interpretation of the Redtail site and other regional site comparisons. Paleoenvironmental information shows modifications for the timespan between 5000 to 3000 rcy B.P. A moderation of the climate, following the Hypsithermal peak in Saskatchewan between 7500 and 6000 rcy B.P. (see Walker 1992: 11-14; Zoltai and Vitt 1990), had lingering effects on the area while modern vegetation was becoming established between 5000 and 3000 rcy B.P. (see MacDonald and Ritchie 1986; Ritchie 1983; Vance *et al.* 1983). The extension of grasslands farther north than present likely provided the incentive for bison to expand their range or length of occupation. At that time, bison hunting people, such as McKean, occupied areas farther northward than the present grassland and parkland ecoregions (e.g. Quigg (1986); Syms (1969); and Tamplin (1977)).

CHAPTER 3

Interpretive Approaches and Background of McKean

3.1) Introduction

This chapter will define the classification terminology and outline interpretive approaches used in the present study. It will also provide a synopsis of McKean research that will include a general historical background, a discussion of classification problems, origin hypotheses and adaptive patterns from current perspectives.

3.2) Definitions and Interpretive Approach

3.2.1) Taxonomic Classification Definitions

The classification of archaeological materials on the Plains is undergoing important changes. Many schemes generally follow Willey and Phillips' (1958) tripartite spatial, temporal and contextual scheme. Their scheme is considered an improvement over the Midwestern Taxonomic System (MTS) which was based only on material culture comparisons (McKern 1939). However, Willey and Phillips' (1958) terminology is very generally defined and they use terms from other systems in a different sense (e.g. phase may be confused with the MTS definition). Also, their scheme lacks the flexibility of sub-units necessary for comparing many sites from many areas. Reeves (1983a: 39), in just such a conundrum, employed the concept of the subphase. His system, a variant of Mulloy's (1958) system, is also vague and awkward and cannot be easily applied to the material in the present study.

Syms (1977) provides more precise definitions and includes more categories for classifying materials. His system is not widely accepted in the Plains, probably because its periodization is Woodland-oriented and his study dealt primarily with ceramic materials. However, it does provide a better framework for organizing widely varying materials. This system includes the terms assemblage, complex, composite, configuration and pattern. A few additional terms are identified or added to these, including site, component and tradition. This modified scheme is presented in Figure 3.1. Other standard terms used in this thesis, such as feature, artifact and ecofact, follow Sharer and Ashmore's (1979) definitions.

"An archaeological site can be defined as a spatial clustering of artifacts, features, and/or ecofacts" (Sharer and Ashmore 1979: 72). *Loci* are defined as culturally based spatial patterns revealed at sites. Sites usually consist of one locus or several loci. Loci may be a cluster of feature(s) and/or other site debris. Some material clusters may be the result of natural processes, and should be so noted.

An *assemblage* is defined as the "... surviving materials, features, and evidence of activities of a single residential group over a short period of time at one site" (Syms 1977: 70). This is roughly equivalent to a single occupation or a few mixed multiple occupations by the same complex. A *component* is a set of assemblages of the same complex at one site (after Thomas 1991: 102-104).

A *complex* is defined as "the total expression of a number of assemblages left by the same group over a sufficiently narrow time period that cultural expressions undergo minor changes" (Syms 1977: 70-71).

A *composite* is defined as "a number of complexes which share a set of traits, both technological and stylistic, that may be conceived as being sufficiently similar to indicate a common and recent ancestry but sufficiently different that microevolutionary changes have taken place" (Syms 1977: 71). This provides a grouping which is lacking, and is much needed, in Willey and Phillips' (1958) and other modifications of this scheme (e.g. Dyck 1983; Frison 1978, 1991; Reeves 1983a).

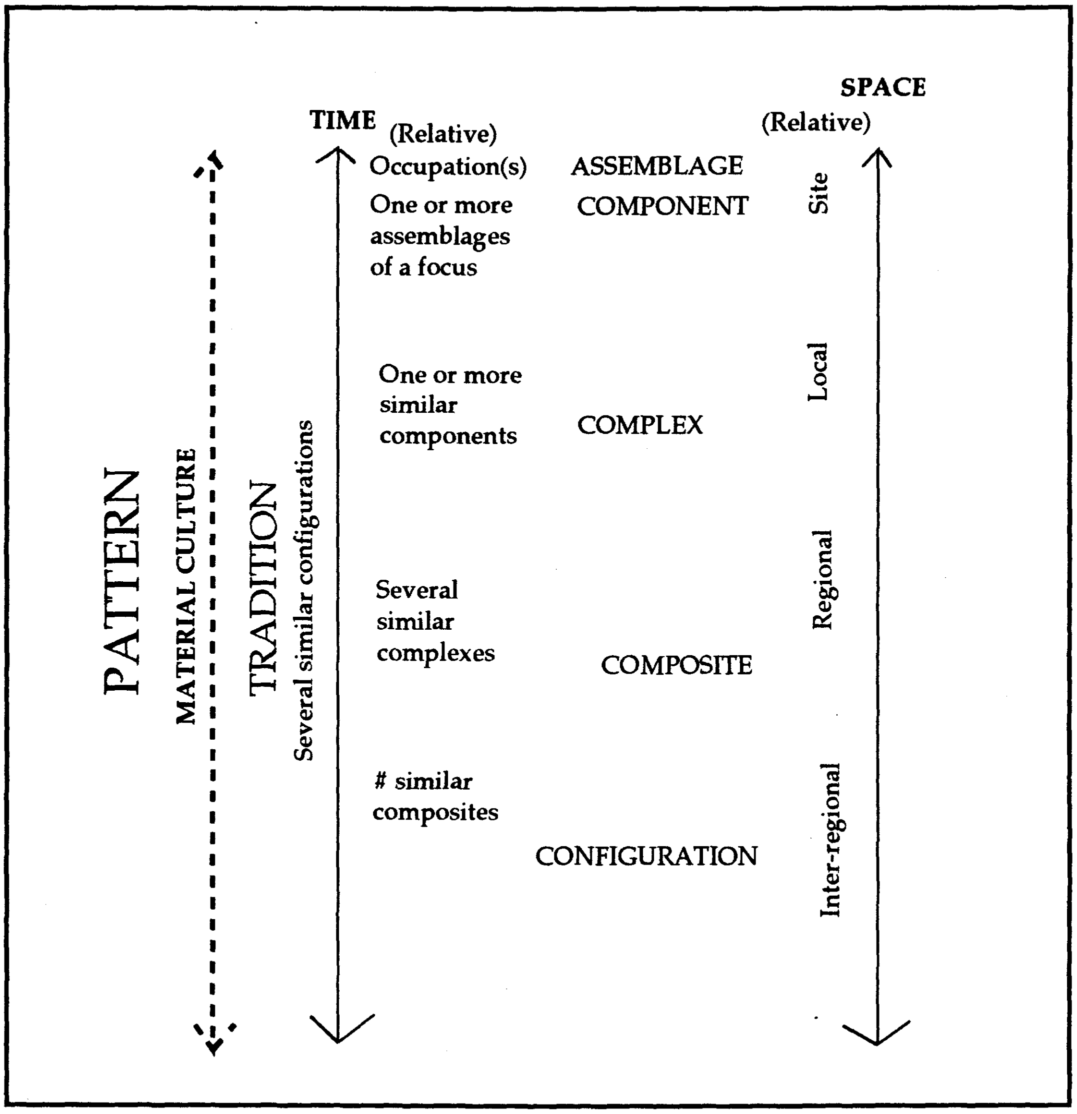


Figure 3.1 Taxonomic System (modified from Syms 1977: 70-72)

Syms (1977: 72) defines a *configuration* as "a cluster of composites sharing sufficient traits to indicate either a distant generic ancestry or co-existence with a similar adaptive strategy that resulted in a cultural convergence." This grouping is spatially broad but is more limited in its temporal span.

Willey and Phillips' (1958: 37) definition of tradition is somewhat more refined than Reeves' (1983a) cultural tradition and is preferred because it maintains its integrity as an integrative unit. Thus, *"an archaeological tradition is a (primarily) temporal continuity represented by persistent configurations in single technologies or other systems of related forms"* (Willey and Phillips 1958: 37).

The term *pattern* is borrowed from the MTS by Syms (1977) to complete his taxonomic framework. "A pattern is a cluster of configurations that share a series of traits reflecting a primary adjustment to a subsistence base" (Syms 1977: 72). This may correlate somewhat with Reeves' (1983a: 40) categories of communal bison hunting, hunting-gathering-horticulture, and generalized hunting-gathering. Also, other adaptive patterns may include Dyck's (1983) Pleistocene hunters, Jennings' (1957) desert culture, equestrian nomadism (Ewers 1955) and the European contact fur trade pattern.

Overall, Syms's (1977) framework is designed to better understand group interaction and variability (e.g. his Co-Influence Sphere Model). Such a framework is necessary to understand McKean variability and influences from likely coexisting Oxbow, Pelican Lake and other cultural patterns. Also, this framework has been used for Late Precontact period materials in northern Saskatchewan, Manitoba and Ontario (e.g. Meyer 1981; Meyer and Russell 1987). If comparisons are to be made to understand the influences between coexisting cultures in the Boreal forest, Parklands and Plains, a common and well defined framework is necessary.

The periodization for the present study cannot follow Syms's (1977) Woodland stages and must use a Plains framework. Many people accept the general scheme of Early, Middle and Late Prehistoric periods (e.g. Mulloy 1958; Reeves 1983a). However, the term prehistoric has become equated with dinosaur times and the usage is considered derogatory by some First People. Also, many First People consider their oral histories are not recognized with the use of the term prehistoric. Recently, the term *precontact* has been suggested to replace prehistoric in a generic sense (David Meyer, personal communication 1992). Use of precontact in a periodization scheme is somewhat vague and Meyer (personal communication, 1993) has indicated that the use of pre-European contact is more precise. In this study the term precontact is used to replace prehistoric because it is shorter, but the intention is that it means pre-European contact.

3.2.2) Typological Approach

Lithics are the best preserved portion of technology in common to Plains archaeological sites and, as such, provide a consistent basis for most material culture comparisons. Both Reeves (1983a) and Bonnichsen (1977) propose systems for analysis that are standardized and meaningful. Bonnichsen (1977: 7-52) reviews five lithic classification systems, those proposed by Krieger (1944, 1956), Rouse (1939, 1960), Spaulding (1953, 1960a, 1960b), Bordes (1969, 1971) and Semenov (1964 and 1971). He criticizes their tendency to focus on either technology, morphology or function to the near exclusion of the other aspects.

Technological and functional approaches require specialized, experienced analysts and are far more time consuming than the measurements and descriptions of the prevaling morphological approach. Another factor to consider is the varying properties of different lithic materials. Bonnichsen's (1977: 74-177) simulation and replication experiments are the main ones which provide evidence that different lithic materials respond differently to the same input variables. Therefore, morphology, function and technology is influenced to varying degrees by the type of lithic material used and this should be taken into account in typological analyses.

Bonnichsen (1977: 39) indicates that if there are errors in assessing the significance of attributes used, there is also an invalid basis for types. An example of such an error is the classification of different stages of a tool's manufacture, use and/or rejuvenation as multiple types (see Deetz 1967: 48; Flenniken and Raymond 1986: 603-616). Type categories, *in practice*, are used to characterize, compare, and to determine the relative age of cultural assemblages, similar to the use of index fossils in paleontology. Since the advent of radiocarbon dating the necessity of this role for types has been somewhat reduced. However, point types are used almost exclusively to classify and age surface collections relatively. This same approach is still frequently used for classifying buried components on account of the limitations of radiocarbon dating or the mixing of components.

Bonnichsen (1977: 53-73) developed a cognitive model and method which incorporates the various approaches to classification such as the type of lithic material, technology, morphology and function. However intriguing this method is, his approach is not followed here due to constraints of time and experience. It is hoped that the methods used herein adequately reflect the various perspectives advocated by Bonnichsen (1977). In the present study, function(s), reworking and rejuvenation of tools is considered in order to evaluate the problems posed by Flenniken and Raymond (1986: 603-616). Also used will be Ericson's (1984) general lithic reduction sequence analysis. This incorporates concepts of biface production, including Keyser's (1985) seven stage biface production model (also, see Johnson 1993).

3.2.3) Spatial Interpretation Approach

Spatial patterning is interpreted from an adaptation perspective by using ethnological data, ethnoarchaeology studies and experimental information. Murray's (1980) survey of ethnological data suggests that there are different household patterns of discard behavior for more permanent structures as opposed to temporary structures. Some ethnoarchaeological studies used for general comparisons include Gifford and Behrensmeyer (1977), Gifford (1980, 1982), Kent (1984) and Yellen (1977). Binford's (1978), Schiffer's (1987) and Stevenson's (1985: 63-81) models for interpreting occupation activities is based on analysis of debris patterning and possible duration of use/reuse. The three zone model relatively measures the duration of the occupation based on discard and displacement zones about hearths and other features. The concept of a public area in the front half of a habitation structure is also recognized and used for interpreting patterns (Tanner 1979; in Finnigan 1982; Portnoy 1981: 213-224). These concepts will be generally applied to the Redtail site's assemblages to assess the variation in type and duration of these habitations.

Siversten (1980) raises some good points about classification of site types. Her study of Early Precontact period sites systematically assesses several site attributes to reconsider the "kill" site types common to this period. I believe that a similar approach could be revealing of assumed "camp" sites and that the whole categorization of site types should be more standardized and evaluated by systematic criteria. The identification of a continuum of overlapping activity loci, which include a broad spectrum of functions may be more useful for understanding human uses of an area (e.g. Yellen 1977). It would be interesting to consider how such activities may have been associated with each other or what variation there may be between sites and within multicomponent sites.

3.3) Background of McKean Studies

3.3.1) Definition of McKean

McKean, originally a site name (Mulloy 1954), has also been used as a point type name and for various taxonomic groups (Frison 1991: 97). Taxonomic categories used with McKean, include complex (Dyck 1983), tradition (Stallcop 1966), complex/ horizon (Syms 1969) and phase (Quigg 1986). This has resulted in much confusion. McKean point types have also been associated with Wettlaufer's (1955) Thunder Creek culture and MacNeish's (1958) Whiteshell focus and Larter focus. Reeves (1983a: 81) has subsumed Larter as a subphase of Pelican Lake. Brumley (1975: 95) has also defined a local variant, the Old Channel Lake subphase, which is a McKean local subdivision in the Cactus Flower site locale. He does not subdivide the variants within McKean over a temporal span. Brumley (1975: 100) notes that this subphase could be subdivided temporally into McKean, Duncan and Hanna but sees "no evidence of significant cultural changes taking place between early and late Old Channel Lake occupations at Cactus Flower."

McKean ranges in age between about 5000 to 3000 rcy B.P. (Frison 1991). This seems to be prior to the extensive use of the bow and arrow on the Plains. Some studies in projectile point weight and size suggest that most McKean Lanceolate, Duncan and Hanna points were used as dart tips with the atlatl (throwing spear) (Fawcett and Kornfeld 1980; Fenenga 1953; and Knight and Keyser 1983). Stratigraphic sequences generally indicate that McKean occupations are located stratigraphically below Middle Precontact period components such as Pelican Lake. They are also stratigraphically above Oxbow and Mummy Cave assemblages. This indicates that McKean and Oxbow were not contemporaneous with McKean and Pelican Lake. McKean has been identified on the basis of several types of projectile points including McKean Lanceolate, Duncan, Hanna and perhaps Mallory

(Stallcop 1966). Generally, McKean Lanceolate type points are defined as having a lanceolate form with a pronounced concave base or basal indentation (Wheeler 1952, 1954). The McKean Lanceolate type ranges from a variety less frequent with parallel blade sides that taper toward the tip and incurve near the base, and a more common variety that incurves at the tip and tapers from approximately midpoint to the base (Wheeler 1952). Green (1975: 163) also notes that this point type has a collateral expanding flake scar pattern that results in an uneven or sinuous dorsal ridge. Some examples of the McKean Lanceolate type may be observed from the Big Kill site (EbNj-2) in Appendix B, Figure 6 and the Crown site (FhNa-86) (see Quigg 1986: 61).

The Mallory point type is lanceolate in form and has a concave or indented base identical to McKean Lanceolate varieties; however, they also have deep, narrow side-notches located well away from the base of the point (Forbis *et al.* n.d.: 80; Lobdell 1973). Schroedl (1976) has noted similarities of this point type to the Pinto Basin's San Rafeal Side-notched type from a similar timespan. The Nebraska, southern Wyoming and Colorado preponderance of Mallory point distribution may suggest that these are the same or culturally related point types.

Duncan type points are described as having a lanceolate form with rounded shoulders and a parallel-sided stemmed haft area that is commonly concave or indented from the base. Hanna type points are also lanceolate in form but are further modified in the haft area. They have defined shoulders some of which are tanged (sharp acute angled), and a stem which expands toward the base, many of which are wide corner notches. Varieties of the Hanna type point include a greater range of basal shapes from concave, to straight to slightly convex (see Brumley 1975; Syms 1969; Wheeler 1954).

There are other point types during the 3000 to 5000 rcy B.P. timespan. These are distinct enough and contextually separate that they are classified separately from McKean. The Oxbow complex has been defined on the association of the Oxbow projectile point type (Dyck 1983: 96-100). This point may be described as having a broad, triangular form with a concave base, and relatively small side-notches which produce lobes of basal edge and well-defined shoulders (Wettlaufer and Mayer-Oakes 1960). This group seems to have existed for a considerable length of time. Morlan (1993: 38) questions 14 of the 33 radiocarbon dates associated with Oxbow in Saskatchewan and proposes a revised age span of 5500 to 3860 rcy B.P. This time span better reflects the recognized stratigraphic separation of McKean and Oxbow.

The Powers-Yonkee point type was, until recently, thought to overlap in time with McKean. Some re-dating of bone and charcoal from the Yonkee site provided an age range of 3100 to 2700 rcy B.P., and discounts the earlier date of 4400 rcy B.P. (Roll 1988 in Frison 1991: 105). This has disassociated the Powers-Yonkee complex from the earlier age range that it was thought to have had before. However, it still may be a later Powder River Basin oriented bison-hunting complex associated with, if not derived from, McKean.

Pelican Lake point types also overlap with the latter part of McKean's timespan, covering about 3300 to 1850 rcy B.P. (Dyck 1983: 105). At least two main varieties of Pelican Lake point types are recognized. The earlier variety, named here for convenience as Pelican Lake I (PL-I) type, is defined by Dyck (1983: 105) as having "straight sides, a straight base and corner-notches which usually leave sharp tangs on the shoulders. This type seems to change through time, the earliest forms having the narrowest base, the largest notches and an almost stemmed appearance." The late Pelican Lake point type (Pelican Lake II/PL-II type) "has straight sides and corner-notches, but a convex, instead of a straight, base" according to Dyck (1983: 105) who also notes that the base tends to be wider, nearer in breadth to its shoulder width. This is because somewhat narrower notches originate either directly from the basal edge corner or from the side (still touching the corner). Reeves (1983a: 7) proposes that Pelican Lake is derived from McKean, based on the similarity to the Hanna point type as well as some stratigraphic and overall assemblage similarities (e.g. at the Cactus Flower site).

Point types similar to the McKean variants are found in the Mixed Wood-Coniferous Forest Ecodistricts areas of Alberta, Saskatchewan and Manitoba (David Meyer, personal communication 1989). Several recoveries of McKean and Duncan-like points have been made from Saskatchewan (see Meyer 1983: 157-159). Other point varieties found in the Mixed Wood-Coniferous Forest Ecodistrict are similar to Hanna, Pelican Lake and Early Side-notched Plains points in appearance (see Gordon 1976: 70; Schroedl and Walker 1978; Wright 1972). More work is required in these northern areas to begin to better understand differences or similarities to McKean materials.

3.3.2) McKean Historical Research Summary

A historical review of McKean will discuss some of the problem areas for current studies. In the 1930s and early 1940s the lower levels of Signal Butte I (Strong 1933,1935), Pictograph Cave I (Mulloy 1943) and Birdshead Cave (Bliss 1950) were found to contain lanceolate, basally-indented projectile points. Mulloy (1954) and Wheeler (1952,1954) defined the point type(s) diagnostic of McKean in the early 1950s. Wheeler (1952, 1954) distinguished three distinct point types; the McKean Lanceolate, Duncan and Hanna. Mulloy (1954), however, defined three similar variants as gradients of the one McKean point type. This has been a typology problem for McKean ever since - lump or split? This problem has been perpetuated because at the type site there is a mixing of occupations within the McKean component at the McKean site.

The McKean site was excavated by Mulloy (1954) who could not distinguish stratigraphic separations within the lower component, which contained the range of McKean point varieties. Recent further excavation of the McKean site indicates that the materials in this lower component are a result of many repeated habitations of the site over a long period of time. Also, there is poor stratigraphic separation and sandy soil has increased the mixing of materials. This is indicated by backplotting point provenienced diagnostic artifacts against profiles and geological assessments (see Kornfeld and Frison 1988).

In the 1950s, stemmed or Duncan varieties of the McKean type points were recovered from Birdshead Cave (Bliss 1950) and the Mortlach site (Wettlaufer 1955). At Danger Cave Jennings (1957) identified six varieties of the McKean type and denoted them W3, W5, W6, W8, W9, and W11. Of these, W6, W8 and W9 were variations of Wheeler's (1954) McKean Lanceolate type.

In the 1960s the range of variation in the McKean type increased considerably (Syms 1969: 4). Sites that produced the previously defined variants of McKean points included Bentzen-Little Bald Mt. (Bentzen 1963), Bentzen-Kaufmann Cave (Grey 1962), and Wedding-of-the-Waters Cave (Frison 1962). However, several new variants were subsumed under the McKean point type. Bentzen (1962) excavated the Powers-Yonkee bison trap which included a few defined McKean types but it was dominated by a distinct new point type. Stallcop (1966: 7) formally defined this squat, triangular point variety as the Powers-Yonkee Eared type. Long considered a variant within or adjunct to McKean, it is now separated in time. Syms (1969: 5) noted the ultimate lumping of point types within McKean when Husted (in Syms 1969: 5) proposed that the McKean type included McKean Lanceolate, Duncan, Hanna and Oxbow varieties as well as Pinto Basin and any other morphologically similar points on the Great Plains, in the Great Basin and Plateau areas.

In the 1970s, the Signal Butte I site produced deep side-notched point varieties that were named "Mallory" (Forbis *et al.* n.d.: 80). Lobdell (1973: 54-56) noted other finds of this deep side-notched variety. They have been recovered from the Sweem-Taylor Shelter (Anonymous 1959: 3-6), 48-SW-303 (Adams and Mack 1970: 19-27) and Signal Butte I (Forbis *et al.* n.d.: 233), as well as the Scoggin site (Lobdell 1973: 53-54). In the Great Basin these deep side-notched points have also been recovered in association with McKean and/or Pinto Basin types. Such occurrences have been found at Danger Cave (Jennings 1968: 137-140), Hells Midden (Lister 1951: 15-48) and Pine Spring's Occupation 2 (Sharrock 1966: 56). Lobdell (1973: 61-63) concluded that these large, deep side-notched points found at the Scoggin site and elsewhere from the same time period are another variety of McKean and not a separate point type. However, I suspect that they indicate a Colorado Plateau and adjacent Plains complex which overlaps in time and interacted with earlier McKean groups. This is outlined in more detail in the McKean origin discussion which follows.

Discrepancies over what point varieties are included in McKean continued into the 1980s and 1990s. Fawcett and Kornfeld (1980: 66) noted that the McKean and Scoggin sites have several modes or clusters of stem/neck widths. These several modes no doubt reflect the differences between the unstemmed McKean Lanceolate, stemmed Duncan points, and narrow-necked notched varieties of Hanna, Mallory or other notched point types from these sites. Other Early, Middle and Late Precontact period archaeological groupings tend to have a more defined range with a normal distribution or single mode (see Fawcett and Kornfeld 1980).

Syms (1969) suggests that McKean point variation, also recognized in Manitoba, may represent the stylistic range representative of different bands cooperating in communal kills and/or camp activities. Quigg (1986: 235-237) has suggested that McKean is distinguished from Hanna at the phase level but suggests that definitions of these cultural phases be expanded to include ranges of other tool types, features and structures. There is the traditional habit of designating one point type to equate with one cultural group, and this obscures variation (Brink 1986: 61). McKean is more variable relative to other cultural constructs on the Plains. Besides projectile point type differences, the subsistence and resource base varies considerably, likely reflecting complexes represented in different environmental zones. However, there are also some similarities of features, other tool types and contextual associations that justify McKean as an overall classification. Brink (1986: 61-63) speculates that the variation within McKean may represent movement of several groups of people, who spread out for prolonged times of separation. He suggests that similar lifeways and material culture may be maintained through occasional rendezvous.

Present taxonomic systems used on the Plains (e.g. Dyck 1983; Frison 1978, 1991; Reeves 1983a) perpetuate the notion of static cultural groups which change suddenly or are replaced by other cultural groups. This may derive from our historic and ethnographic beliefs of eastern Woodland groups moving onto the Plains (see Hoebel 1980; Parks, Liberty and Ferenci 1980; Russell 1991). Reeves (1983a: 39) notes however that there are no geographic borders on the Plains to promote local adaptations of small segregated populations. This corresponds with his use of 'phase' as a large spatial unit and a concern with interphase variation as opposed to intraphase variation (Reeves 1983a: 38-48). Plains-adapted peoples may thus have readily adopted styles or technologies through interaction with other Plains groups and/or peripheral groups (e.g. diffusion from within and/or peripheral to the Plains). Meyer and Epp (1990) support an opposing hypothesis for boreal forest and Plains groups interaction during the Late Precontact period on the Northern Plains. Their research suggests that cultural and physical contact was restricted "to the narrow effective ecotone on the southern edge of the boreal forest and the forest immediately adjacent to this ecotone" (Meyer and Epp 1990: 339). During the Middle Precontact period the Parklands were likely expanded in size (farther north but similar southern margins) and the smaller population or group sizes would have increased the potential for interaction of boreal forest and Plains groups. Also, many Plains groups may have persisted, developed and changed within the Plains area, much like Reeves (1983a) indicates with his use of the Napikwan and Tunaxa traditions. This variability as well as continuity are better dealt with by adopting Syms's (1977) taxonomic framework.

3.3.3) McKean Origin Theories

Jennings (1957) initially suggested that McKean originated from the "Desert culture" of the Great Basin. This has been, at least in part, supported by Brumley (1975), Syms (1969) and Reeves (1983b). Mayer-Oakes (1970: 365-369) has outlined possible Eastern Woodland influences from the "Old Copper" or "Shield Archaic". Holmer (1978), Green (1975), and Schroedl (1976) have suggested a Plains origin, at least in the Great Basin and Colorado Plateau areas. Benedict and Olson (1973) and Benedict (1981) have proposed Colorado Mountain origins. Reeves (1983b) and Syms (1969) have also noted possible northern Boreal forest influences.

Reeves (1983b: 7) stated that the "Eastern Great Basin is the only area where there is a temporal, morphological and technological linkage in lanceolate points to coeval and earlier forms i.e., Humbolt Concave Base." However, Green (1975) analysed the technological variation in flake scar patterns between the

Little Lake series (Humbolt Concave Base and Pinto subvarieties) from over 16 sites and collections in Idaho and the Great Basin, and 17 representative McKean points from the McKean site (Green 1975: 159-171 and xix-xxii). He noted distinctive technological differences. These were primarily based on the Little Lake series' consistent parallel oblique flaking pattern and a high prevalence of edge grinding or dulling. He also described the Little Lake series as having a bifacial preform technology. He seemed to contrast this with McKean which he described as having points made from "... blade-like flakes ... [or large] expanding flakes with one or more dorsal ridges ..." (Green 1975: 163). Contrary to Green's viewpoint, Keyser (1982, 1985) provided substantial proof that McKean had a biface preform technology. There was also a common use of flake blanks for points and Green's (1975) misconception was likely related to the small sample size of McKean points examined. However, the parallel oblique flaking and basal edge grinding in the Little Lake series is distinctly different from any McKean points known to me.

Regardless of these technological differences, Reeves (1983b), overall, considers the stone and bone assemblages to be quite comparable between Humbolt and McKean. Reeves (1983b: 7) cites similarities based on descriptions of Wilson Butte (Gruhn 1961), Danger Cave (Jennings 1957), Weston Canyon Shelter (Miller 1972) and Mummy Cave (Husted n.d. in Reeves 1983b: 7). He also notes that Holmer's (1978) discriminate function analysis has indicated a close link between Humbolt and McKean. Reeves (1983b: 7-8) suggests that San Rafeal Side-notched or Mallory point types in association with McKean are a Western Mountain/Plateau development.

However, Black (1991: 1-29) has reintroduced the concept of a Mountain tradition in this area, which he believes is derived or influenced by Great Basin connections. Black (1991: 17-19) criticizes Benedict's (1975, 1978, 1979) contention of McKean materials in the Colorado Rocky Mountains. He essentially relates the Mount Albion complex to this Mountain tradition but overemphasizes differences between this Mountain tradition and McKean. In fact, split cobble technology, flake points (heavily reused), utilized flakes, pithouses, small blade-like tools and the reoccupied camp pattern are present in McKean (Brumley 1975; Forbis *et al.* n.d.; Frison 1991; Frison and Walker 1984; Keyser and Davis 1985; Kornfeld and Frison 1988). These are only a few of the common characteristics, and the similar collateral flaked lanceolate stemmed and notched points are not that distinct from many McKean point types.

Reeves (1983b) concludes that the northern and eastern periphery of the Great Basin and perhaps some of the Colorado Plateau and Rocky Mountains are the most probable homeland of McKean. "They dispersed onto the Plains from this area about 2700 B.C." (Reeves 1983b: 8). "Homeland" implies an actual migration of people from this area into the Plains. Based on the technological differences posed by Green (1975), which I consider significant, such a movement of people would likely have maintained such a distinctive technology. Black (1991: 12) states that the presence of a parallel oblique flaking pattern is not uncommon in the earlier part of the Plains Middle Precontact period, but he does not indicate with which components they are associated. Diffusion of the lanceolate point forms may be possible.

Keyser and Davis (1985: 130) review McKean origins and propose a diffusion of a "techno-complex through a series of in situ North-western Plains populations." This techno-complex may have diffused due to its advantages in producing a variety of biface tools and subsequent reuse/modification into other tools. Earliest dates for McKean are generally associated with the Big Horn Basin (Frison 1978: 53; Syms 1969: 174-175). However, the specialized local adaptations of McKean are suggested by Keyser and Davis (1985: 130) to reflect *in situ* populations that adopted a similar stone tool technology perhaps from the Big Horn Basin area. The predominant use of local lithic materials by McKean may support these *in situ* populations (Brumley 1975; Francis 1980; Reher 1985; Syms 1969). It seems that the early Big Horn Basin McKean had interactions with the northern Great Basin and Mountain tradition from which it adopted or derived the lanceolate point forms and some other technological aspects. Thus, Reeves (1983b) may be correct in his ideas regarding the ultimate origins for McKean, but diffusion, as opposed to a migration mechanism, may be part of this "origin". It seems that earlier McKean materials may reflect a stronger tie to the northern Great Basin (McKean Lanceolate point forms), but later McKean materials may be greater influenced by the Mountain tradition as well as other Plains groups.

3.3.4) McKean Adaptation Hypotheses

Sites containing McKean in Wyoming, southern Montana, North Dakota, South Dakota and parts of Nebraska and Colorado, have grinding slabs and rock-lined pit features. These are suggestive of plant processing activities (Brumley 1975: 98). Though there seems to be an emphasis on bison procurement, this southern McKean variant consistently uses a broad variety of other local fauna. Bison hunting appears to dominate farther north in Alberta, Saskatchewan, northern Montana and southwestern Manitoba, where there is also an apparent lack of grinding stones and slabs. Overall, McKean, Duncan and Hanna have been combined into a generalized gathering and bison-hunting Plains culture group. A northern variant of McKean is thought to have been less focused on plant resources than the central and southern groups who had more plant resources requiring processing, and may have had less access to bison (Reeves 1983b).

The stronger dependence on game and a lesser emphasis on plants in the diet of Northern Plains McKean has been suggested as indicating a change in the adaptation of McKean people, apparently after migrating northward (Reeves 1983b). However, this difference may be overemphasized due to better preservation in the Big Horn Basin's dry and sheltered sites. Also, the few McKean sites excavated on the Canadian Plains have not had the fine-screen recovery or flotation analysis that many of these other sites in the Dakotas and Wyoming have had. However, after an analysis of the Redtail site and comparisons with other sites in the study area a judgement may be made.

Tratebas (1985) recovered grinding implements from sites in the Black Hills with a probable winter seasonality. Rather than being used for vegetable processing, he proposed that these implements were used for pounding dried meat or pemmican. However, ethnographic analogy and experiments by Adams (1988: 307-315) also suggest the possibility that they were used as hide-processing stones. The assumption that grinding stones are plant food processing implements is unwarranted, unless substantiating evidence is present (e.g. flotation data, features and disassociation from stone working or bone marrow processing areas).

It appears that, generally, McKean groups habitually reoccupied the same site many times, reusing materials and features (Kornfeld and Frison 1985; Spath 1987:124). This reuse by subsequent groups is used as an explanation for the perceived variation that is becoming more obvious in spatial patterns (e.g. Johnson 1984; Kent 1984; Murray 1980; Yellen 1977). It may also have produced the appearance of larger populations or more intensive activities (Spath 1987: 124). If seasonality can be determined, in addition to other contextual evidence to indicate reoccupation, this can provide important data for understanding movements and social interaction of the groups that were responsible for the McKean archaeological remains.

3.4) Discussion

In the study area, McKean nearly spans the Middle Precontact II period, about 4300 to 3100 rcy B.P. Vickers (1986: 11) compared cultural chronology sequences from the Wyoming Basin (Frison 1978), Saskatchewan (Dyck 1983) and Alberta (Brumley and Rushworth 1983; Reeves 1969, 1983a; and Vickers 1983). He noted that variation in McKean's timespan is revealed in each of these subregional perspectives. Basically, McKean dates earliest in the Wyoming Basins. Also, Brumley and Rushworth (1983) distinguish between McKean and Hanna point type dominated components which appear to peak at different times. Quigg (1986) supports this with stratigraphic separation of McKean and Hanna components at the Crown site.

The McKean tradition includes McKean Lanceolate point type-dominated and Hanna point type-dominated configurations. This taxonomic proposal will be tested and refined in later comparisons within the study area. Evidence from the Redtail site and other McKean components provide the main data towards this objective. Other interpretations at the Redtail site will involve spatial distribution interpretations. Overall, patterns between each assemblage at the Redtail site will be compared, and then these will be compared in detail with assemblages at the Cactus Flower and Crown sites.

CHAPTER 4

. Redtail Site Stratigraphy and Dating

4.1) Introduction

The Redtail site excavations involved very complex strata. These strata were dominated by alluvial and colluvial deposits. There was additional erosion and redeposition by run-off channels, and possibly flood deposits from the South Saskatchewan River. The 15 main cultural layers were recognized, based on field observations, three-point artifact provenience and cross-correlations (backplotting) with 106 metres of profiles. Paleotopographic contour maps helped to reveal past surfaces and aid in the assessment of cultural and natural patterns. The condition of the bone was also important in providing clues about the rates of deposition, erosion and amount of vegetation associated with the different layers. These data will provide a basis for recognizing the post-depositional disturbances at the site.

Bone samples provided radiocarbon dates for cultural layers 11, 12, 13 and 15. There were also some thermoluminescence (TL) samples (hearth-baked soil and fire-broken rock) submitted from layers 8, 12 and 13 for dating. This technique will be discussed so that future applications may be more successful.

4.2) Excavation and Recording Methodology

This discussion presents the field methods employed in the 1988 and 1989 excavations. Original testing methods used in 1982 are summarily discussed in the first chapter and in Walker (1983). The location of the excavations and the decision to remove a block area are related to this site's interpretive potential within Wanuskewin Heritage Park, as it reveals a large area for the public to see. However, it also provides a continuous sample of the living floor area for revealing remnants of past activities. The excavation sequence of the m^2 units was related to numerous individuals in the two archaeological field schools.

Initially, units were separated within the allotted block area. Later, an E-shaped trench network allowed improved observation of the natural layers while excavating. This proved to be a good approach, and the completed block was 9 m by 4 m in area with additional units extending upslope and across the slope (see Figure 1.4).

Layer 13 had yielded certain diagnostic points of the McKean lanceolate style and a radiocarbon date of 4280 $\pm$85 rcy B.P. The focus of this thesis was then decided to be on McKean occupations. Layer 14 lacked diagnostic items, and there was only a single radiocarbon date from layer 13(4). Thus, there was the possibility that this layer might be associated with McKean as well. It was therefore decided to include layer 14 in the focus as a possible McKean layer. Only a single unit (122N 110E) of layer 15 was exposed in the first season. Three adjacent units were taken down to some of the layer 15 sublayers in the following season. Overall, this resulted in units ranging in depth from about 1.5 m to 2.7 m, which were generally shallower upslope and deeper downslope. The trowel was the primary excavation tool, though the flat-ended shovel was used in removing soil from the noncultural layers. Dr. E. G. Walker had planned on excavating the lower occupations in 1990 or 1991, in addition to further work on the remainder of the potential pithouse in the north of the block. However, no further excavation was done and in 1992 the block was filled in (as the unbraced walls were collapsing).

Excavations followed natural layers. Generally, thicker cultural layers were subdivided into 5 cm arbitrary levels, and thick noncultural layers were subdivided into 10 cm arbitrary levels. Though this was the preferred approach, there was considerable variation due to the great number of inexperienced excavators and limited supervision. Cultural occupation layers were deduced from field observations on forms and in notes, artifact point provenience and correlations with 106 detailed profiles (backplotting for each unit). Larger rocks and bone fragments, features, stone tools and identifiable bones were measure in by three point provenience. Depths of items were taken employing a line level attached at the ground surface of the southwest corner of each m^2 unit. All southwest corner unit data were connected by readings from a theodolite placed at site datum (100N 100E). Depth measurements were taken to the bottoms of the artifacts, and diagonal or vertical orientation of artifacts was noted and measured. Horizontal measurements utilized mapping plan forms or easting and northing measurements. Each one m^2 was subdivided into four 50 cm^2 quadrants, which were screened through 6 mm mesh and labeled separately for each natural layer and arbitrary level. Two power screens were used, as were two to three hand screens.

Unit level information was kept on descriptive level record forms (modified from Finnigan *et al.* 1985: 5-10), planview forms and feature forms. Color slides and black-and-white photographs were judgementally taken of those planview exposures which had a fair number of items or identifiable materials. Close-up photographs were taken of stone tools located *in situ* , as well as bison mandibles, a complete bison skull and other items that would disintegrate upon removal. When possible, close-up photographs were also obtained of features, including both planviews and profiles, before and after the fill was removed for samples. Soil samples for flotation analysis were taken (as much as possible) from identifiable hearth, pit, ash, and charcoal concentrations. There were also several soil samples taken from natural layers across the block for soil and particle-size analyses.

A profile drawing was made of all four walls in every excavated m^2 unit (except two). Color slides and black-and-white photographs were also taken of each wall in every unit. Many of these profile photographs were taken from an oblique angle with a wide-angled lens. However, shots of the trench profiles and the block's outer walls were photographed straight on. The block's outer walls were also recorded on videotape, with the aid of a camera crew of Terry and Jane Gibson. Together, these methods provide a valuable record of the Redtail site's strata.

A systematic fine-screen sample was obtained from the Redtail site. The northeastern quadrant in 1988, and both northeast and southwest quadrants in 1989, were fine-screened using water to wash most of the soil out. Water was pumped up from the South Saskatchewan River and the pump system proved to be troublesome at times. Though there was a fine mesh covering the input hose, there were occasional foreign objects from the river sucked up through the line. This source of contamination should be considered when analysis of the fine-screen samples is undertaken.

Prior to washing samples in the fine-screen apparatus, the soil was screened through a 6 mm mesh handscreen onto a polyethylene sheet. This process retrieved the larger cultural items and removed larger pebbles and roots. The 6 mm-screened soil which remained on the plastic was then scooped up into the pails and the volume was estimated (in litres). Then this soil was washed through the 1.7 mm mesh metal fine-screen. All 19 units in 1988 had a 25% fine-screen sample for each natural layer, while the remaining 25 units of the 1989 season had a 50% sample of cultural layers 8 through 14. The fine-screen samples were packaged into two litre plastic zip-lock bags and taken into the laboratory daily to spread out to dry on cotton cloth. The samples dried in a few days to weeks, depending on the soil type and recent rains that flowed into the excavation units. The dried samples were then rebagged and boxed.

No in-depth analysis of fine-screen samples has been undertaken because there was neither time, funds nor expertise to do this. However, some preliminary analyses of a few samples from the McKean component have produced recent insect remains, charcoal fragments, rodent bones, microflakes and other small bone fragments (Joe Krieg, personal communication 1991). Future analysis of these fine-screen samples is planned by Dr. R. E. Morlan. It will be interesting to compare results of this study's primarily macrofaunal interpretation, with those of the microfaunal analyses. Soil samples have been collected by Dr. R. E. Morlan and stored in a freezer, so that pollen analysis may also be another future endeavor.

4.3) Natural and Cultural Stratigraphy

4.3.1) Natural Stratigraphy

The Redtail site's present surface is moderate to gently sloping (about 4.5° or 8.4%) at the toe section of the incline. Depositional and erosional processes have weathered the cultural remains, and may also have moved or redeposited materials. This section describes and discusses the observed natural layers and their paleosurfaces in relation to each other.

A study of the soil is required in order to understand the geomorphic and taphonomic influences on the site through time . A generalized sampling approach was suggested by Dr. Dan Smith and Dr. Tom Stewart from the Department of Geography after a field visit and through later discussions. They noted that a detailed analysis would probably reveal only general processes occurring at the site but a general approach could provide some information. Thus, three columns of soil samples were collected from different areas in the block excavation. These samples were collected from natural layers or 5 cm arbitrary units within the thicker natural layers. A general particle-size analysis was carried out to obtain data about depositional agents which may have dominated throughout the toe-slope's development. Other chemical analyses were not undertaken due to lack of funds, but there are several soil samples that may be analyzed in the future.

A total of 35 soil samples was sieved for the particle-size analysis. The -1, 0, 1, 2, 3 and 4 ø size fractions were weighed. The 5 ø and smaller size particles were weighed as the pan category. A summary of the particle-size analysis data is presented in Table 4.1. This is not as refined a method as could be undertaken but is likely fitting for the relatively large (5 cm thick) vertical samples removed. Even some of these reflect mixing of different deposition events.

Overall, the samples indicate a distinction between three main types of sediment. This in turn suggests different sources and/or modes of transport. Samples that have an abundance of the larger size fractions are colluvium, primarily derived from upslope erosion of glacial till. These include sizes of material that the river cannot transport due to energy limitations, such as the -1 ø to 1 ø size range. Samples with a higher percent of finer material are alluvium, or more specifically flood derived fines (e.g. mud is equivalent to 4 ø and the pan). Sand is represented by 2 ø and 3 ø size categories and, in the samples, tends not to vary much in terms of weight percent (between about 30% to 50%). These particle-sizes represent material that the river normally carries. Some samples represented a combination of bank undercutting, gravity flow (colluvium) and normal flow sedimentation (3 ø) and are a result of undercutting in addition to sediment found on the riverbed during periods of normal flow. Under conditions of normal flow the South Saskatchewan River transports primarily medium to fine grained sand (2 ø and 3 ø sizes) (Amundson 1991).

Excavation revealed a complex of weakly developed Chernozemic soils. This accumulation of hillwash sediments on a gentle slope is derived from sources of brown Chernozemic soils, reworked fluvial/alluvial sediments, riverine deposits, glacial till and sandy glacial-lacustrine deposits (Acton and

Table 4.1 **Redtail Site Particle-Size Analysis Data**

RTC #	Lab #	Cultural Layer/ Natural Layer	Munsell Color	Color Description	Depth (cm DBS)	Mean (Phi)	Stand.Dev. (Phi)	Skewness (Phi)	Kurtosis (Phi)	#Modes
1	8	Sod/Ah1	10YR5/2	Gry-Brn	0 to 5	2.97	1.42	0.25	0.98	2
2	17	Ae2	10YR6/4	Lt.Yel-Brn	5 to10	2.99	1.48	0.26	1.11	2
3	15	1 & 2/Ahb3	10YR5/2	Gry-Brn	10 to 15	2.85	1.45	0.20	1.16	3
4	10	3 & 4/Ahb5	10YR4/2	Dk.Gry-Brn	15-20	0.86	3.62	-0.50	1.59	3
5	12	Ae6	10YR6/4	Lt.Yel-Brn	20-25	2.66	1.80	-0.09	2.08	2
6	16	6/Ahb8	10YR5/2.5	Brn-Gry	25-30	2.69	1.21	0.14	1.02	2
7	9	Bm9 & Ahb10	10YR6/4+3/1	Lt.Yel-Brn&V.Dk.Gry	30-35	3.10	1.39	0.03	0.87	2
8	7	7(2)/Ahb10	10YR3/1	V.DK.GRY	35-40	3.24	1.56	0.23	0.95	2
9	11	Bm13	10YR7/2-6/2	Lt.Gry - Lt.BrnGry	40-45	2.79	1.38	0.19	1.21	3
10	14	8(1)/Ahkb14	10YR6/1	Gry	45-50	2.68	1.31	-0.04	1.03	3
11	20	Bm17	10YR6/2	Lt.Brn-Gry	50-55	2.92	1.28	0.04	1.02	1
12	13	8(2)/Ahkb16	10YR6/1	Gry	55-60	2.87	1.68	0.31	1.66	3
13	23	Bm17, Exp1	10YR6/4	Lt.Yel-Brn	60-65	1.86	2.11	-0.44	3.43	2
14	21	Bm17, Exp2	10YR6/4	Lt.Yel-Brn	65-70	2.27	1.82	-0.20	2.62	2
15	24	9/Ahku18	10YR6/2-8/1	Lt.Brn-Gry -Wt	70-75	2.20	2.00	-0.21	2.36	2
16	19	Bm19, Exp1	10YR5.5/3.5	Pale Lt.Yel-Brn	75-80	0.92	2.64	-0.52	1.74	2
17	18	Bm19, Exp2	10YR5.5/3.5	Pale Lt.Yel-Brn	80-85	-0.24	3.57	-0.65	0.72	2
18	25	Bm 19, Exp3	10YR5.5/3.5	Pale Lt.Yel-Brn	85-90	2.06	1.33	-0.12	1.65	2
19	22	Bm19, Exp4	10YR5.5/3.5	Pale Lt.Yel-Brn	90-95	2.25	1.13	0.06	1.30	2
20	26	Bm19, Exp5	10YR5.5/3.5	Pale Lt.Yel-Brn	95-100	2.12	1.02	0.06	1.12	2
21	34	10/Ahkb20	10YR5.5/2.5	Lt.Brn-Gry	100-107.5	2.58	1.19	0.10	1.05	3
22	33	Aeu21	2.5YR6/4	Lt.Yel-Brn	107.5-110	2.66	0.94	0.19	1.74	1
23	32	11/Ahkb22	10YR3/1	V.Dk.Gry	110-112.5	3.43	1.02	0.02	0.70	2
24	31	Aeu23 & Ahkb24	10YR5/2+3/1	Gry-Brn&V.Dk.Gry	112.5-115	2.87	0.92	0.01	0.59	2
25	30	Aeu25	10YR5/2	Gry-Brn	115-117.5	2.71	1.34	-0.01	1.06	1
26	27	13(1&2)/Ahkb26	10YR5/1	Gry	117.5-123	2.64	1.21	0.17	1.08	1
27	28	Aeu27	2.5YR6/2	Lt.Brn-Gry	123-126	2.07	0.95	0.04	1.10	1
28	29	13(3&4)/Ahkb28	10YR5/2	Gry-Brn	126-135	2.21	1.18	0.09	1.37	2
29	35	Ahkb26 & Aeu27	10YR6/3.5	Pale Lt.Yel-Brn	135-140	2.29	1.31	0.17	1.56	2
30	3	Aeu21	10YR5/2	Gry-Brn	107-111.5	2.43	1.19	-0.19	1.50	1
31	5	Aeu25	10YR5/2	Gry-Brn	121.5-125.5	2.47	1.32	0.15	1.15	1
32	6	13(1)/Ahkb26	10YR5/1	Gry	117.5-127.5	2.14	1.44	0.09	1.32	1
33	4	13(2)/Ahkb26	10YR5/2	Gry-Brn	140-150	2.07	1.28	0.02	1.65	2
34	2	Bm29	10YR6/3.5	Pale Lt.Yel-Brn	140-146.5	1.81	1.75	-0.27	2.17	2
35	1	14/Ahb32	10YR5/2	Gry-Brn	150.5-157.5	2.04	1.31	0.06	1.71	2

Ellis 1978). Within the excavation block soils range from coarser sands and fine sands, through intermediate loamy sands, to the finer sandy loams. These soils were defined based on *The System of Soil Classification for Canada* (Canada Department of Agriculture 1974). Layers were identified by organic and mineral horizon criteria. A natural layer or stratum is generally defined as having "certain unifying characteristics, properties, or attributes that distinguish it from adjacent layers" (Canada Department of Agriculture 1974: 229).

The descriptions of the soil profile specifically derives from a column in the northeast quadrant of unit 124N 106E, with deeper layers described from unit 122N 110E (Table 4.2). This location corresponds with the particle-size sample locations and that information will be incorporated throughout. Layers that occur out of these units are mentioned, as are variations in all layers across the excavation. A numeric subscript suffix is used for easier reference of layers in sequence from top to bottom.

The general reconstruction of the geomorphic processes which acted on the site may be gleaned from paleotopographic maps and particle-size data, in addition to the basic soil descriptions in Table 4.2. A microtopographic surface map with 10 cm contour intervals of the paleosurfaces for occupations may provide some insight into geomorphic processes acting at the site over time.

The present surface (Figures 1.3 and 1.5) indicates that the excavation block is presently between a main incised channel and a smaller surface channel. The slope dips about 4.5° or 8.4% from the west end of the block to the east, with a slight shift northward toward the bottom half (Figure 4.1). The buried soil horizons Ahb_3, Ahb_4, $Ahbu_7$ and Ahb_8 roughly parallel the present surface horizon. These upper layers also contain finer alluvial sediments in comparison to the deeper layers (Table 4.1). Layers Ahb_{10} and Ahb_{12} are at intermediate stages of alluvial infilling between Ahb_8 and $Ahkb_{14}$.

Table 4.2 Redtail Site Soil Layer Descriptions from Unit 124N 106E

Layer	Depth (cm DBS)	Descriptions
Ah_1	0-3.5	Grayish brown (10YR 5/2 d); loamy fine sand; friable; humose, abundant, very fine and fine roots; abrupt, smooth boundary; 3 to 4 cm thick.
Ae_2	3.5-7	Light yellowish brown (10 YR 6/4 d); loamy fine sand; plentiful, very fine and fine roots; abrupt, smooth boundary; 3 to 4 cm thick.
Ahb_3	7-12	Grayish brown (10 YR 5/2 d); loamy sand; plentiful, very fine and fine roots; abrupt, smooth boundary; 5 to 6 cm thick. Splits into two layers in other areas across the block. An intermittent fine gravel lamella occurs at the bottom boundary of this layer.
Ae_4	12-17	Light yellowish brown (10 YR 6/4 d); loamy sand; plentiful, very fine and fine roots; abrupt, smooth boundary; 5 to 6 cm thick.
Ahb_5	17-22	Dark grayish brown (10 YR 4/2 d) loamy sand; plentiful, very fine and fine roots; abrupt, smooth boundary; 5 cm thick. Splits into two layers in other areas across the block.
Ae_6	22-25	Light yellowish brown (10 YR 6/4 d); sand with gravel; few, very fine and fine roots; abrupt, smooth boundary; 3 to 4 cm but thicker downslope.
$Ahbu_7$	mid Ae_6	Intermittent, grayish brown (10 YR 5/2 d); loamy sand; few, very fine and fine roots; abrupt, smooth boundary; 2 to 3 cm thick. Splits in some areas into two layers.
Ahb_8	25-28	Brownish gray (10 YR 5/2.5 d); loamy sand; few, very fine and fine roots; clear, smooth boundary; 3 to 4 cm. In places had an abrupt boundary.
Bm_9	28-31	Light yellowish brown (10 YR 6/4 d); sand; few, very fine and fine roots; abrupt, smooth boundary; 3 to 4 cm thick. It was transected by many fine to medium sized decayed root structures.

Table 4.2 Redtail Site Soil Layer Descriptions from Unit 124N 106E, continued

Ahb_{10}	31-33.5	Very dark gray (10 YR 3/1 d); fine sandy loam; few, very fine and fine roots; clear, smooth boundary; 2 to 3 cm thick. It was transected by many fine to medium sized decayed root structures. In some areas Ahb_{10} and Ah_{12} blend together.
Ahe_{11}	33.5-36	Light gray(10 YR 7/2 d); sandy loam; few, very fine and fine roots; clear, smooth boundary; 2 to 3 cm thick. It was transected by many fine to medium sized decayed root structures.
Ahb_{12}	36-38.5	Very dark gray (10 YR 3/1 d); fine sandy loam; few, very fine and fine roots; clear, smooth boundary; 2 to 3 cm thick. It was transected by many fine to medium sized decayed root structures.
Bm_{13}	38.5-46	Light gray to light brownish gray (10 YR 7/2 to 10 YR 6/2 d); loamy sand; very few, very fine and fine roots; clear, smooth boundary; 7 to 10 cm thick.
$Ahkb_{14}$	46-51	Gray (10 YR 6/1 d); loamy sand; loamy sand; very few, very fine and fine roots; clear, smooth boundary; 5 to 6 cm thick.
Aek_{15}	51-54	Light brownish gray (10 YR 6/2 d); loamy fine sand; very few, very fine and fine roots; clear, smooth boundary; 3 cm thick.
$Ahkb_{16}$	54-58	Gray (10 YR 6/1 d); loamy sand; clear, smooth boundary; 5 to 6 cm thick. In the north central portion of the block it splits into two layers.
Bm_{17}	58-67.5	Light yellowish brown (10 YR 6/4 d); sand and some gravel; clear, broken boundary; 8 to 10 cm thick.
$Ahku_{18}$	67.5-74	White (10 YR 8/1 d), in areas of high $CaCO_3$ content, to light brownish gray (10 YR 6/9 d); loamy sand; clear, broken boundary; 6 to 10 cm thick.
Bm_{19}	74-100	Light pale yellowish brown (10 YR 5.5/3.5 d); sand with gravel lamella, particularly in the upper 10 to 15 cm of the layer and thin to thick intermittent silt/clay lamella occur toward the bottom of this deposit; gradual, wavy boundary; 25 to 27 cm thick.

Table 4.2 Redtail Site Soil Layer Descriptions from Unit 124N 106E, continued

$Ahkb_{20}$	100-107	Light brownish gray (10 YR 5.5/2.5 d); loamy sand; abrupt, smooth boundary; 6 to 8 cm thick. In some areas it splits into two layers. A few silt/clay lamella occur intermittently.
Aeu_{21}	107-110	Light yellowish brown (2.5 Y 6/4 d); fine sand; abrupt, broken boundary; 2 to 3 cm thick.
$Ahkb_{22}$	110-112	Very dark gray (10 YR 3/1 d); fine sandy loam; abrupt, smooth boundary; 2 to 3 cm thick but in some places is 6 to 8 cm thick and splits into two layers in some places.
Aeu_{23}	112-114	Grayish brown (10 YR 5/2 d); sand and fine sand; abrupt, broken boundary; 2 to 3 cm thick.
$Ahkb_{24}$	114-116	Very dark gray (10 YR 3/1 d); sandy loam; abrupt, smooth boundary; 2 to 3 cm thick here but often 5 to 8 cm thick. Splits into two layers in southwest corner of block.
Aeu_{25}	116-118	Grayish brown (10 YR 5/2 d); loamy sand; abrupt, smooth boundary; 2 to 3 cm thick but 6 to 8 cm thick in places.
$Ahkb_{26}$	118-123	Gray (10 Yr 5/1 d); loamy sand; abrupt, smooth boundary; 6 to 10 cm thick. Splits into two other layers downslope but also joins with Ah_{29} upslope.
Aeu_{27}	123-127	Light brownish gray (2.5 Y 6/2 d); sand; abrupt, smooth boundary; 0 to 6 cm thick.
$Ahkb_{28}$	127-134	Grayish brown (10 YR 5/2 d); sand; abrupt, smooth boundary; 6 to 12 cm thick. Splits into two other layers downslope but also joins with Ah_{27} upslope.
Bm_{29}	134-145+	Light to pale yellowish brown (10 YR 6/3.5 d); sand; indeterminate boundary; 11+ cm thick.

Table 4.2 Redtail Site Soil Layer Descriptions from Unit 122N 110E, continued

Ahb_{30}	145-148	Grayish brown (10 YR 5/2 d); sand; clear, broken boundary; 4 to 8 cm thick. Splits into other layers downslope but also joins with Ah_{32} upslope.
Bm_{31}	148-155	Light to pale yellowish brown (10 YR 6/3.5 d); sand; clear, broken boundary; 11+ cm thick.
Ahb_{32}	155-160	Grayish brown (10 YR 5/2 d); sand; clear, broken boundary; 4 to 8 cm thick. Joins with Ah_{30} upslope.
Bm_{33}	160-171	Light to pale yellowish brown (10 YR 6/3.5 d); sand and gravel; abrupt, smooth boundary; 11 to 26 cm thick.
Ahb_{34}	171-173	Grayish brown (10 YR 5/2 d); sand; clear, broken/smooth boundary; 0.5 to 2 cm thick.
Bm_{35}	173-202	Light to pale yellowish brown (10 YR 6/3.5 d); sand and gravel; clear, broken boundary; 14 to 34 cm thick.
Ahb_{36}	202-205	Gray (10 Yr 5/1 d); loamy sand; abrupt, broken boundary; 2 to 4 cm thick. A few cobbles at this layer.
Ae_{37}	205-215	Light to pale yellowish brown (10 YR 6/3.5 d); sand and gravel; clear, broken boundary; 7 to 10 cm thick.
Ahb_{38}	215-219	Gray (10 Yr 5/1 d); loamy sand; abrupt, broken boundary; 3 to 10 cm thick. A few cobbles at this layer.
B/C_{39}	219-231	Light to pale yellowish brown (10 YR 6/3.5 d); gravel and cobbles with sand; undetermined boundary; 12+ cm thick.

Layer $Ahkb_{14}$ is in the middle of a colluvial and alluvial (Table 4.1) infilling of a depression from the preceding buried horizon, $Ahkb_{16}$ (Figures 4.2 and 4.3). The surface orientation at both of these layers dips from the east to the west sides of the excavation but angles further south in the bottom half, especially for $Ahkb_{16}$ (Figure 4.3). The overall slope is 6.9% in layer $Ahkb_{14}$ and 7.5% in layer $Ahkb_{16}$ from west to east. A rounded depression on the northern edge of the block may have been the location of a shallow pithouse (Figure 4.3). However, it may also be a natural depression formed by a run-off catchment area. Further excavation is necessary to determine more certainly which is the case. The deeper $Ahkb_{22}$ horizon has a slight depression in this same area. The upper block dips east-northeast but turns drastically (about 65°) at this slightly depressed area to a southeasterly orientation (Figure 4.4). It appears that this was a small catchment area for upslope runoff, which then proceeded to flow to the southeast. This depression seems to have developed as a catchment area from a smaller depression evident in the $Ahkb_{24}$ horizon just below (Figure 4.5). Prior to this, in layers $Ahkb_{26}$ and $Ahkb_{28}$, there was a distinct east-northeast upper block slope dip with the shift in surface flow direction to the southeast in the bottom half of the block (Figures 4.6 and 4.7). On the other hand, layer Ahb_{30} indicates a general east dipping slope (Figure 4.8).

The upper block of Ahb_{26} has a steeper 16% slope while the lower half has only 2.5% slope (Figure 4.6). This difference in slope may account for the splitting of layers downslope for this layer. The steeper portions of the slope remain more active, and may accumulate sediment slower, while gentler portions of the slope accumulate sediment faster, tending to split the layers. This difference in slope angle also corresponds with differences in the slope dip or directional orientation. The southeastern dip of the lower portion of the block seems to increase from $Ahkb_{28}$ to the greatest domination of the block in $Ahkb_{16}$.

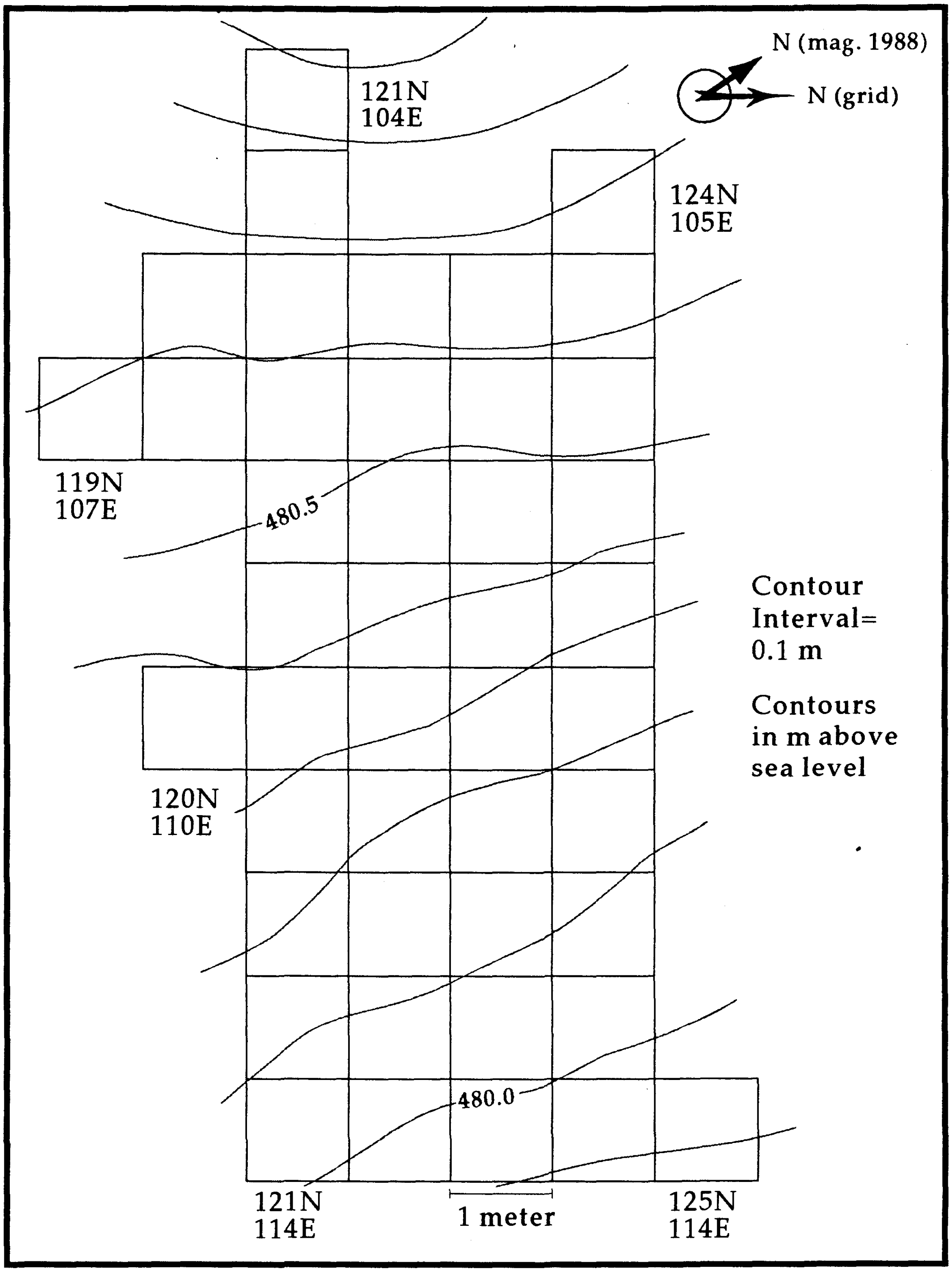


Figure 4.1 Present Microtopographic Surface of Block Excavation

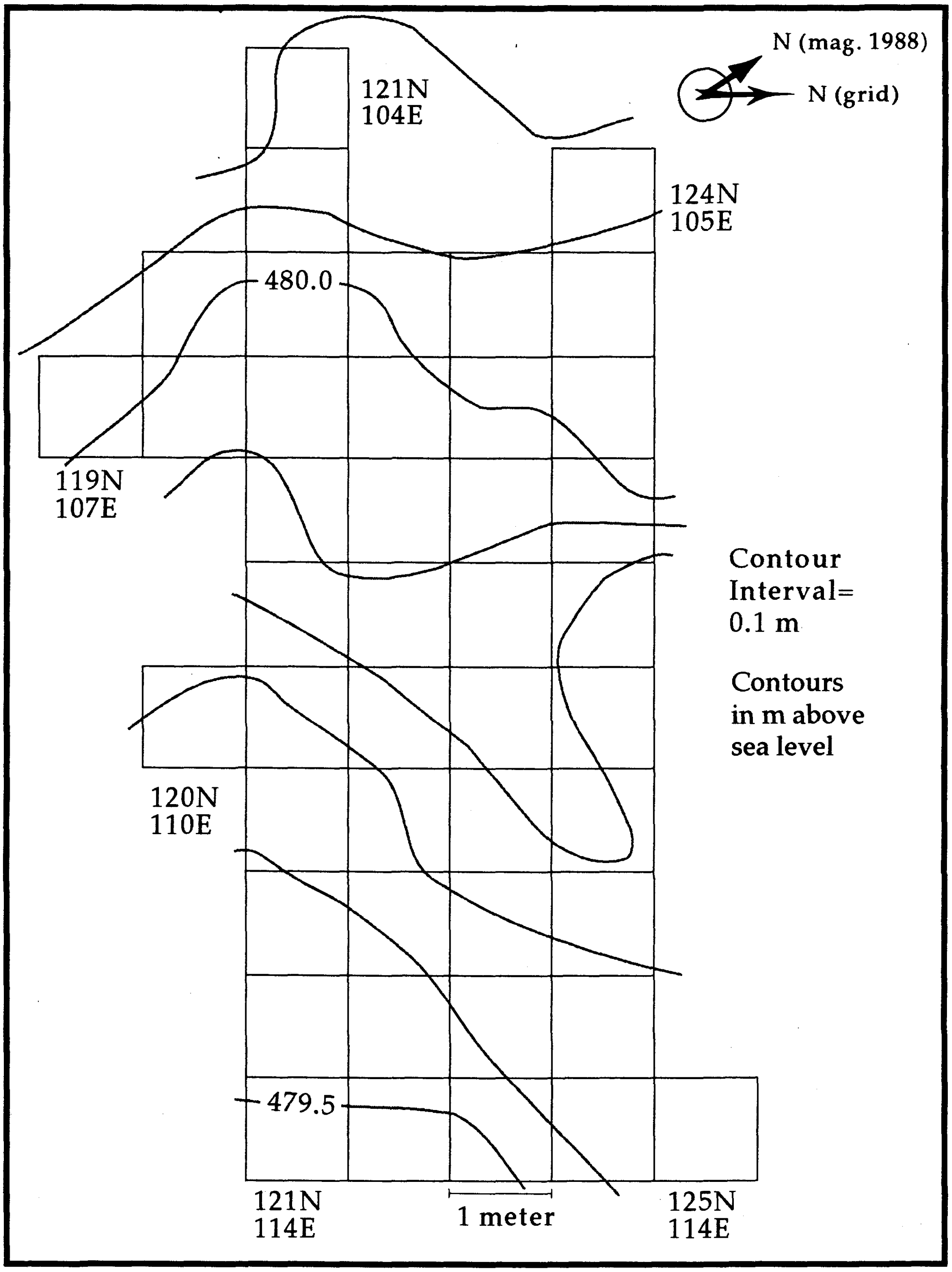


Figure 4.2 Ahkb14, Layer 8(1), Paleosurface of Block Excavation

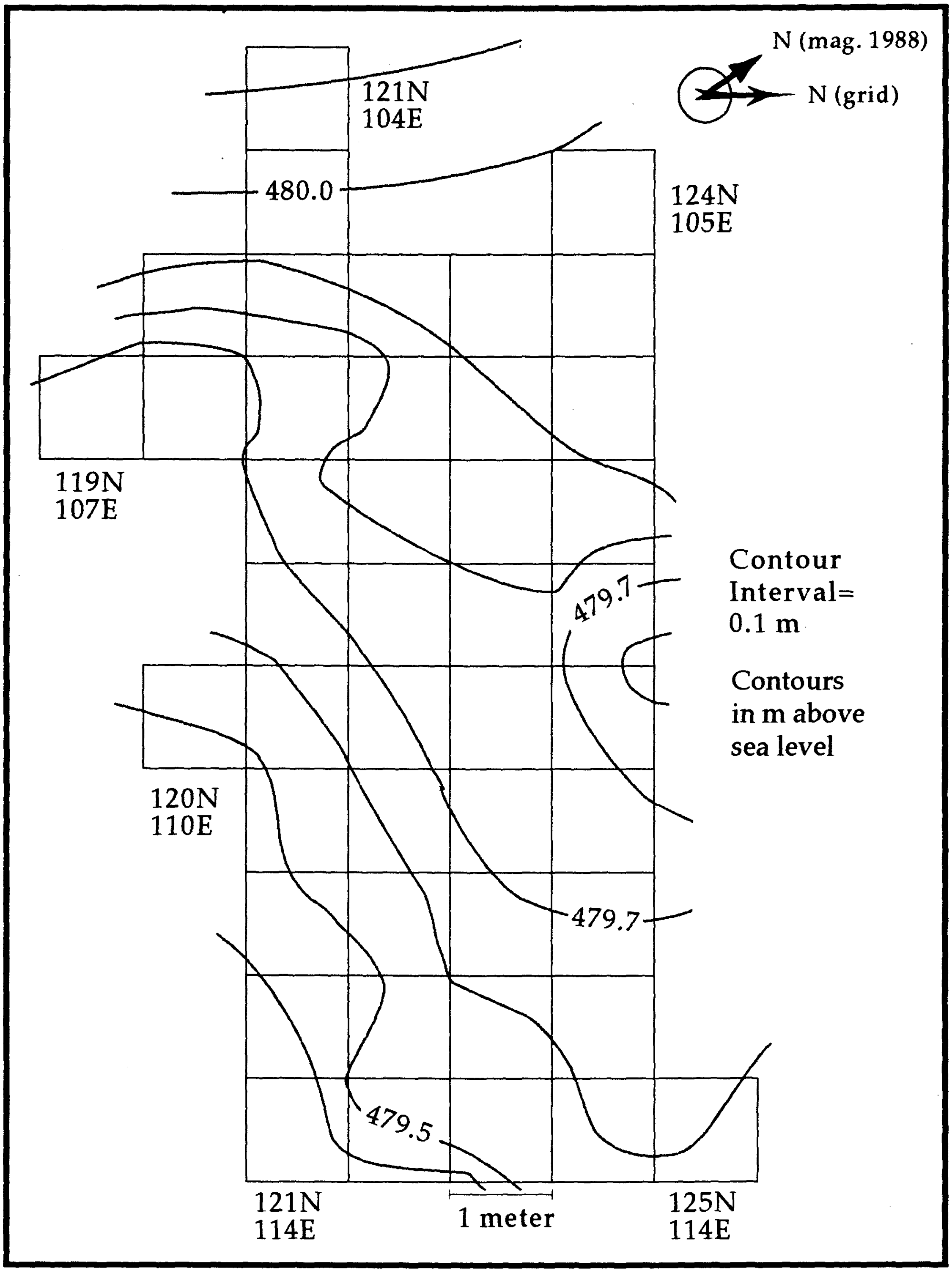


Figure 4.3 Ahkb16, Layer 8(2), Paleosurface of Block Excavation

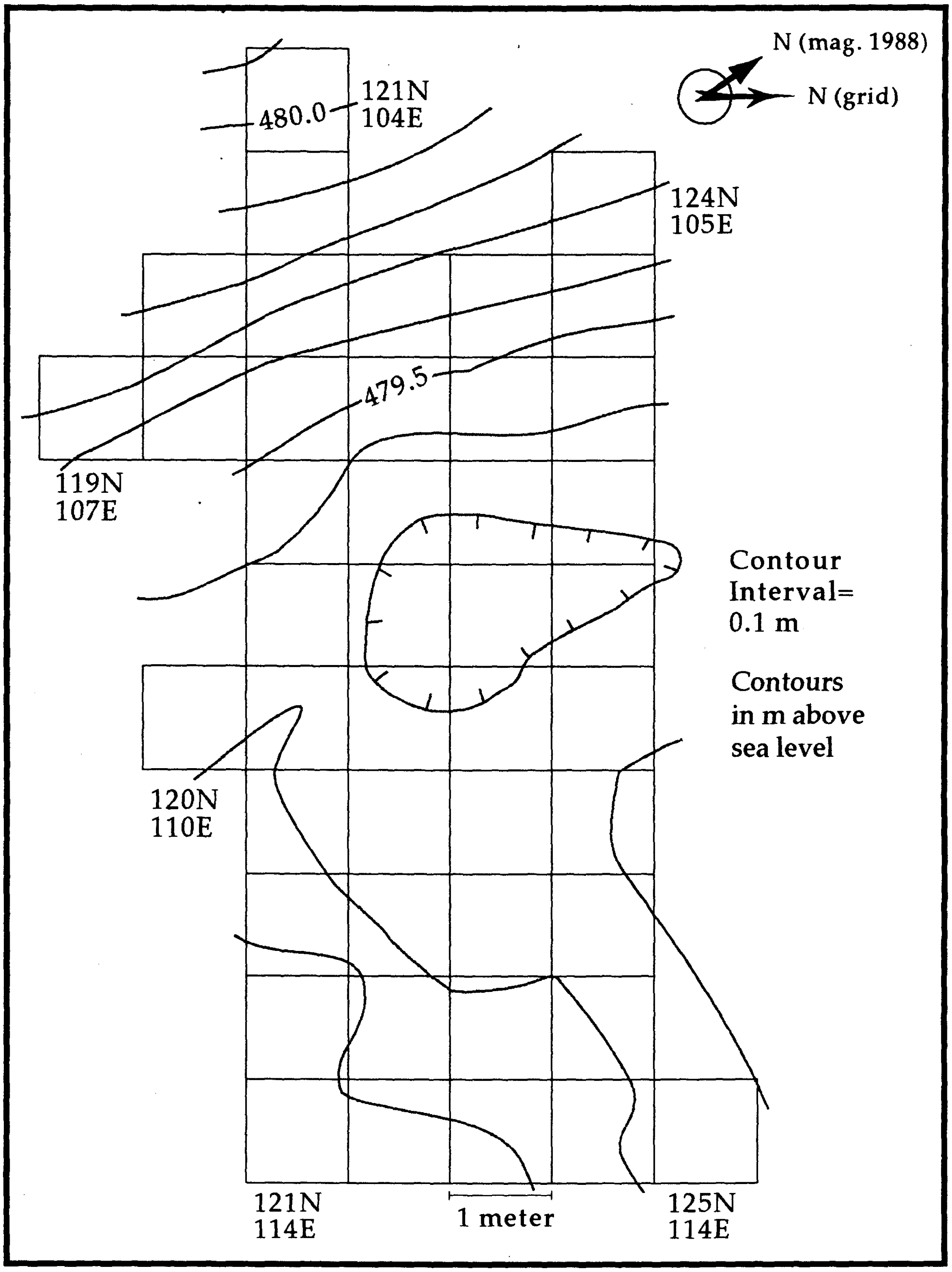


Figure 4.4 Ahkb22, Layer 11, Paleosurface of Block Excavation

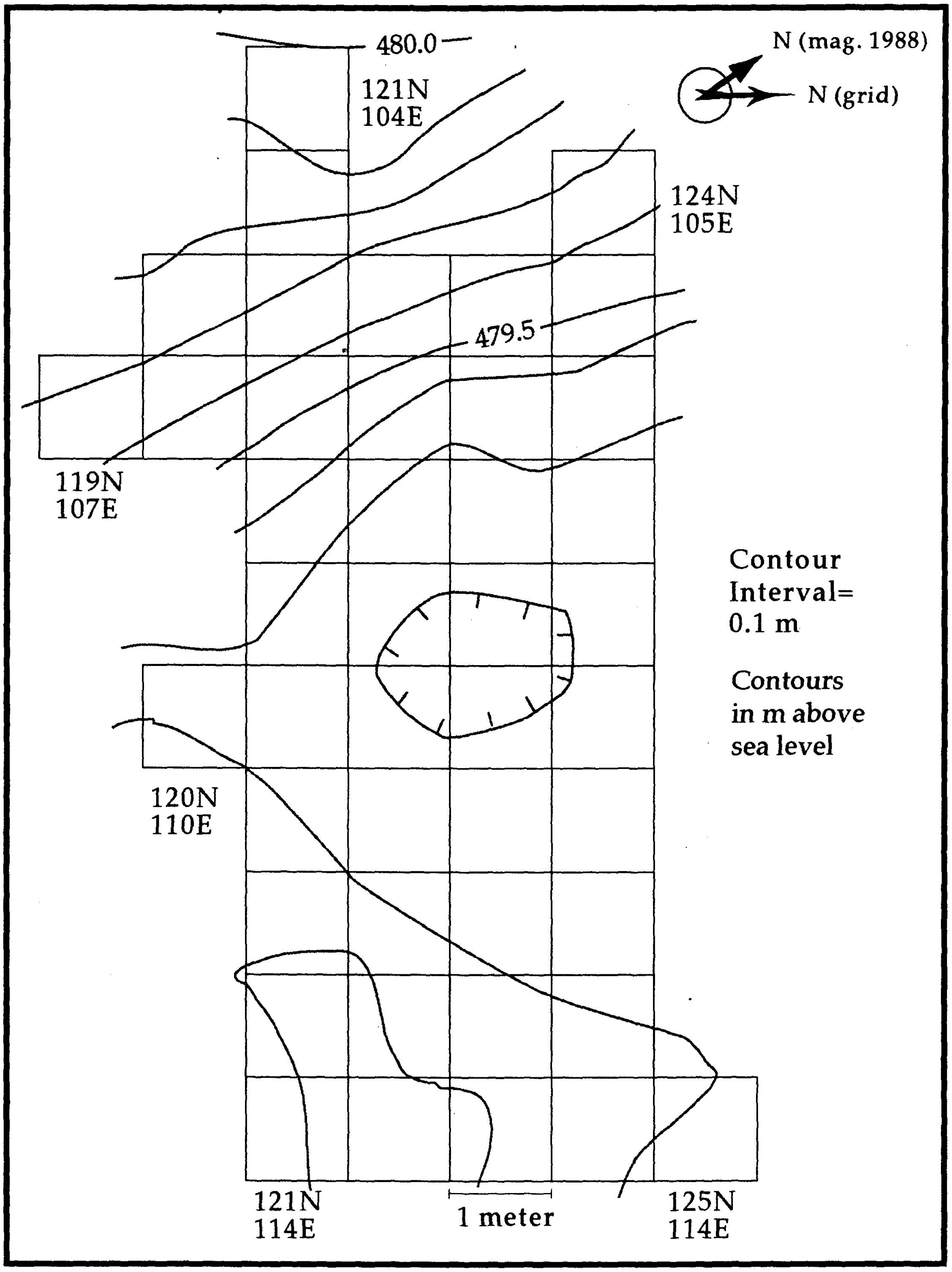


Figure 4.5 Ahkb24, Layer 12, Paleosurface of Block Excavation

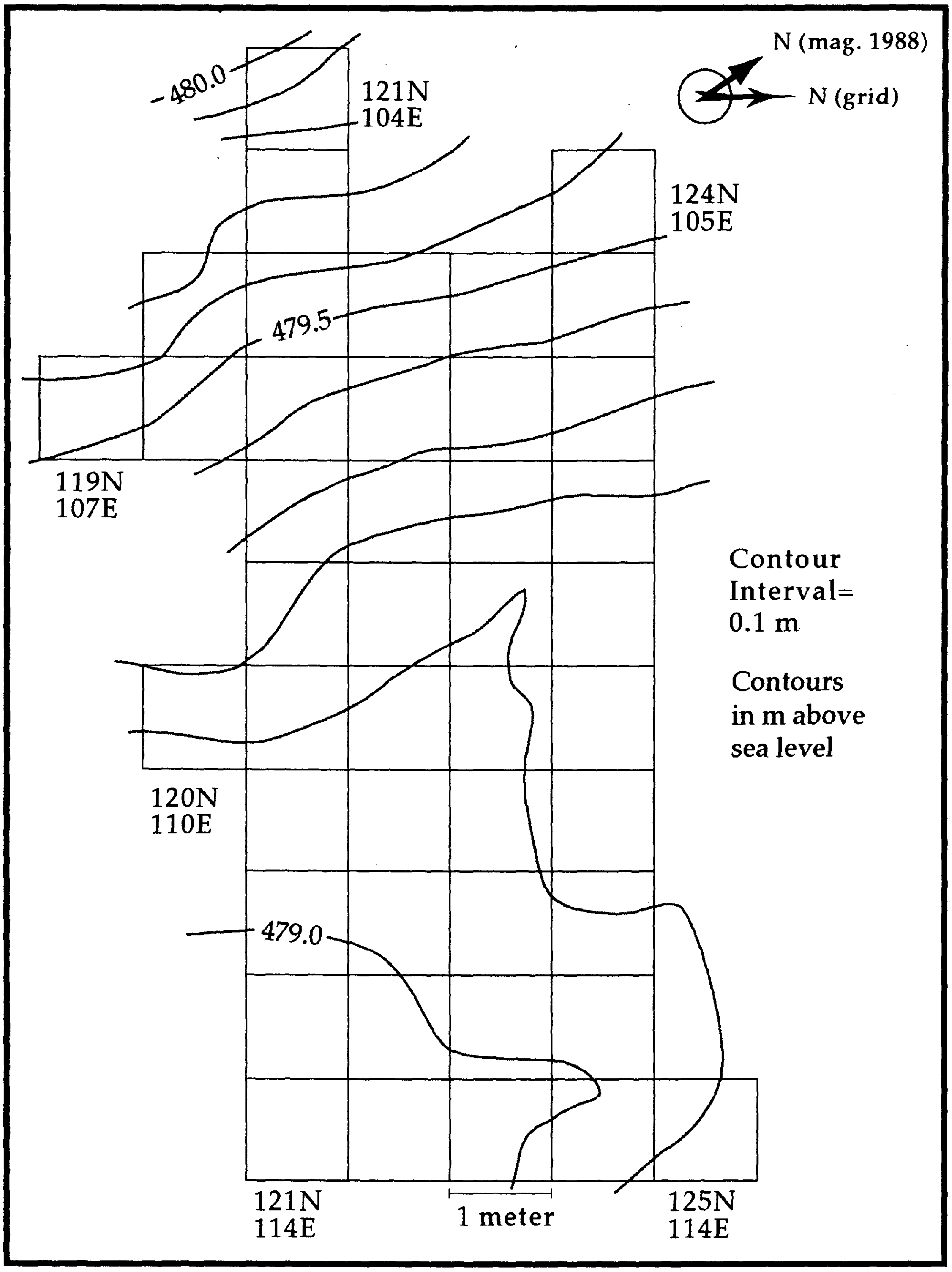


Figure 4.6 Ahkb26, Layer 13(1), Paleosurface of Block Excavation

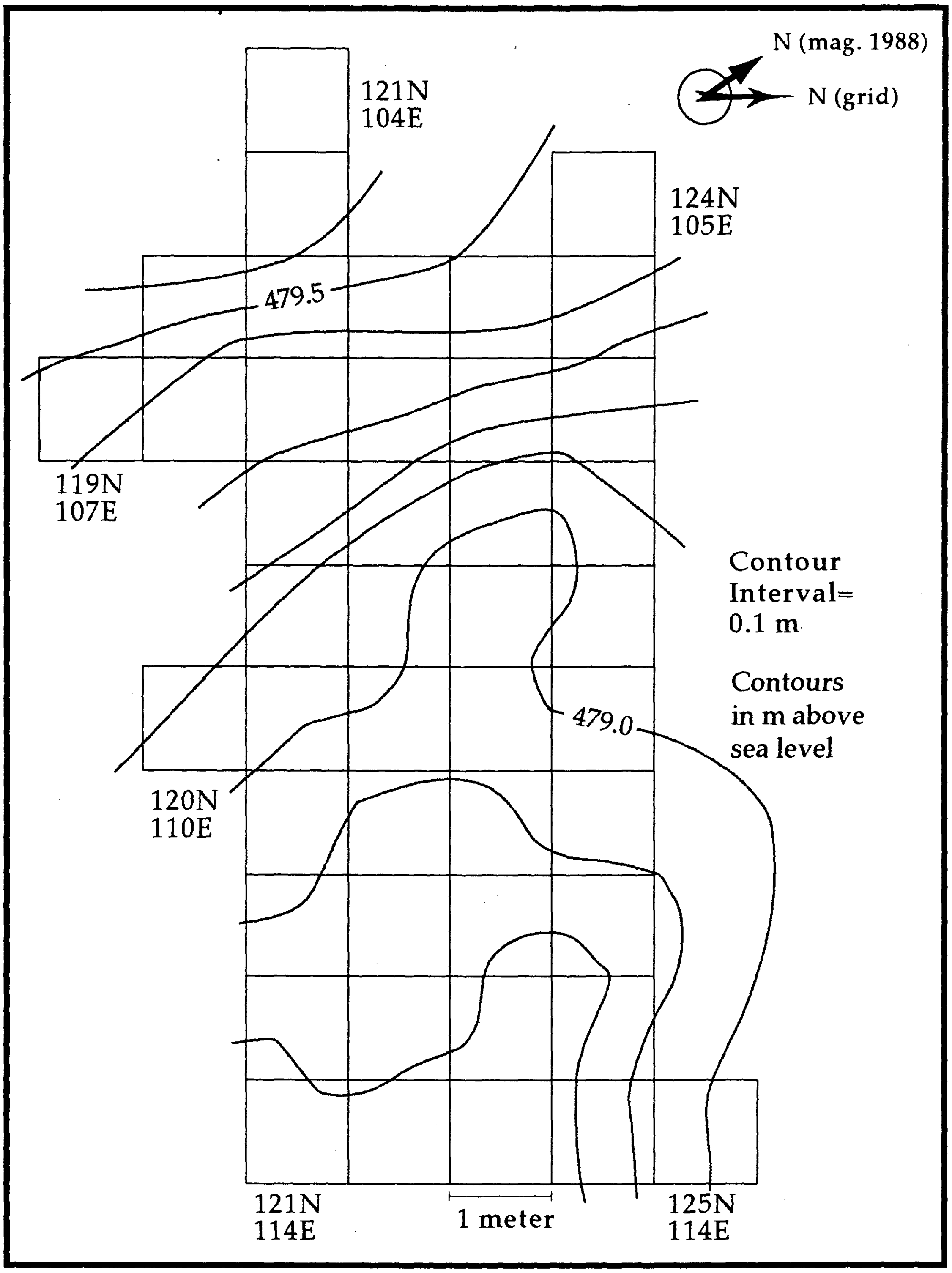


Figure 4.7 Ahkb28, Layer 13(3), Paleosurface of Block Excavation

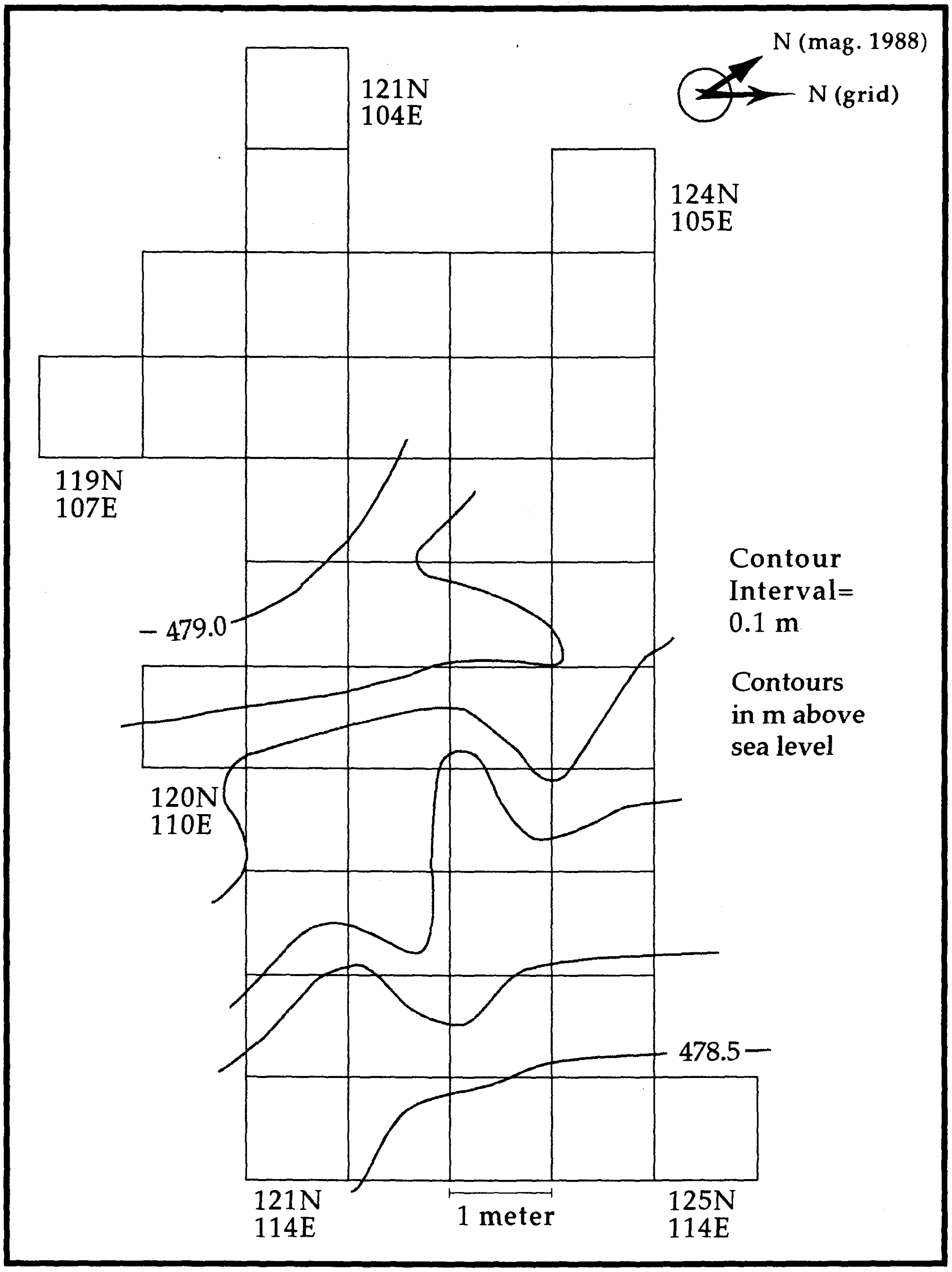


Figure 4.8 Ahb30, Layer 14(1), Paleosurface of Block Excavation

Subsequent infilling from the east-dipping upper slope then begins, until it dominates the entire.block as indicated by the present surface. The lowest layers, like the present surface, seemed to have this eastern dip dominating the block (Figure 4.8).

4.3.2) Cultural Occupation Layers

The seven uppermost cultural layers are summarized together as they are not a part of this thesis. Cultural layers 8 through 15 are reviewed here and are dealt with in detail in the following chapters. Table 4.3 presents a correlation of these cultural layers to the natural layer designations as discussed in the preceding section.

Table 4.3 Cultural Layer Correlations to Natural Layers

Cultural Layer/ sublayer(s)	Natural Layer(s)
sod	Ah_1
1 and 2	Ahb_3
3 and 4	Ahb_5
5	$Ahbu_7$
6	Ahb_8
7(1)	Ahb_{10}
7(2)	Ahb_{12}
8(1)	$Ahkb_{14}$
8(2)	$Ahkb_{16}$
9	$Ahku_{18}$
10	$Ahkb_{20}$
11	$Ahkb_{22}$
12	$Ahkb_{24}$
13(1) and 13(2)	$Ahkb_{26}$
13(3) and 13(4)	$Ahkb_{28}$
14(1), 14(2) and 14(3)	Ahb_{32}
15(1)	Ahb_{36}
15(2) and 15(3)	Ahb_{38}

Profiles of the upper block and lower block, as presented in Figures 4.9 and 4.10, continue from one to the other to provide a view of the splitting of organic rich layers farther downslope. Figure 4.10 also provides the cultural layer's base sequence. This base sequence is based on the deepest unit, 122N 110E, which was initially used as a central connector of layers for other units.

The east wall profile of the block is presented in Figure 4.11. Splitting and convergence of organic-rich layers is apparent. Note that thicker organic bands containing multiple natural layers had soil differences (as noted in the natural soil layer descriptions) and thin lamellae of separation that are not apparent at this scale of presentation. A photographic survey, presented in Figures 4.12, 4.13 and 4.14, of the lower block's south wall and the southern portion of the east wall may indicate the complex stratification better. Some water erosion of the loose sandier layers between some of the organic-rich cultural layers is evident. Several root and rodent disturbances are also apparent. The diffuse nature of the lower layers (primarily layer 14) are noted in Figures 4.12 and 4.13, but the wet condition of this lower layer in Figure 4.14 reveals the higher organic content and finer soils in the bands.

A portion of the block's north wall profile is presented in Figures 4.15 and 4.16. These show the cross-section through the probable pithouse structure and some of its associated pits and hearths. The hole in the wall is due to the removal of a substantial hearth feature from this pithouse for thermoluminescence dating. Splitting and convergence of lower organic layers is also evident. A large disturbance, below and to the left side of the pithouse cross-section, is right at the intersection point of the majority of the layer splitting. This is also reflected in the paleosurface map for layer 11 (see Figure 4.4). The disturbance includes some larger cobbles, and with the paleosurface map suggests that a small run-off channel may be the cause of this natural feature. It may have overflowed

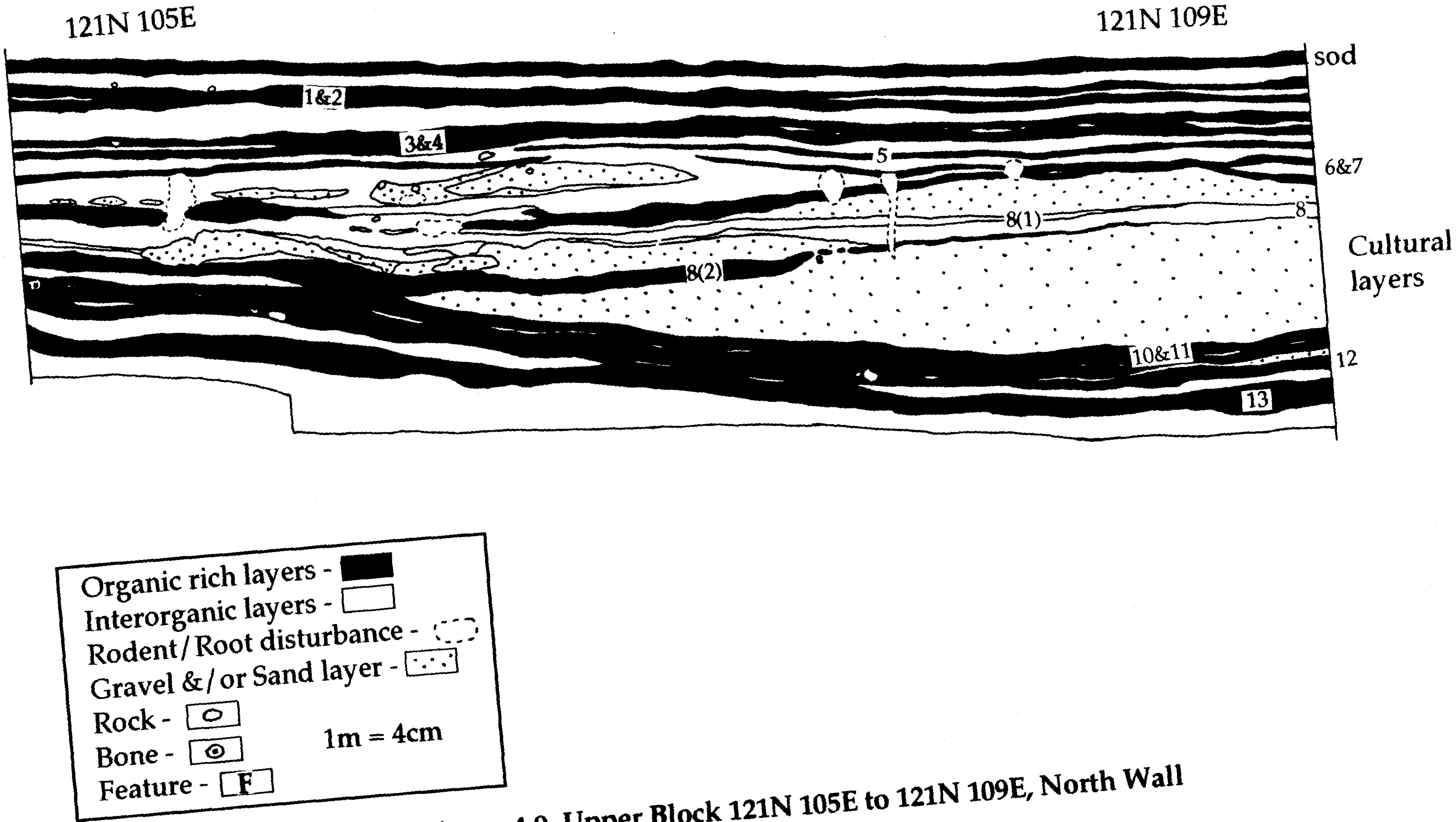


Figure 4.9 Upper Block 121N 105E to 121N 109E, North Wall

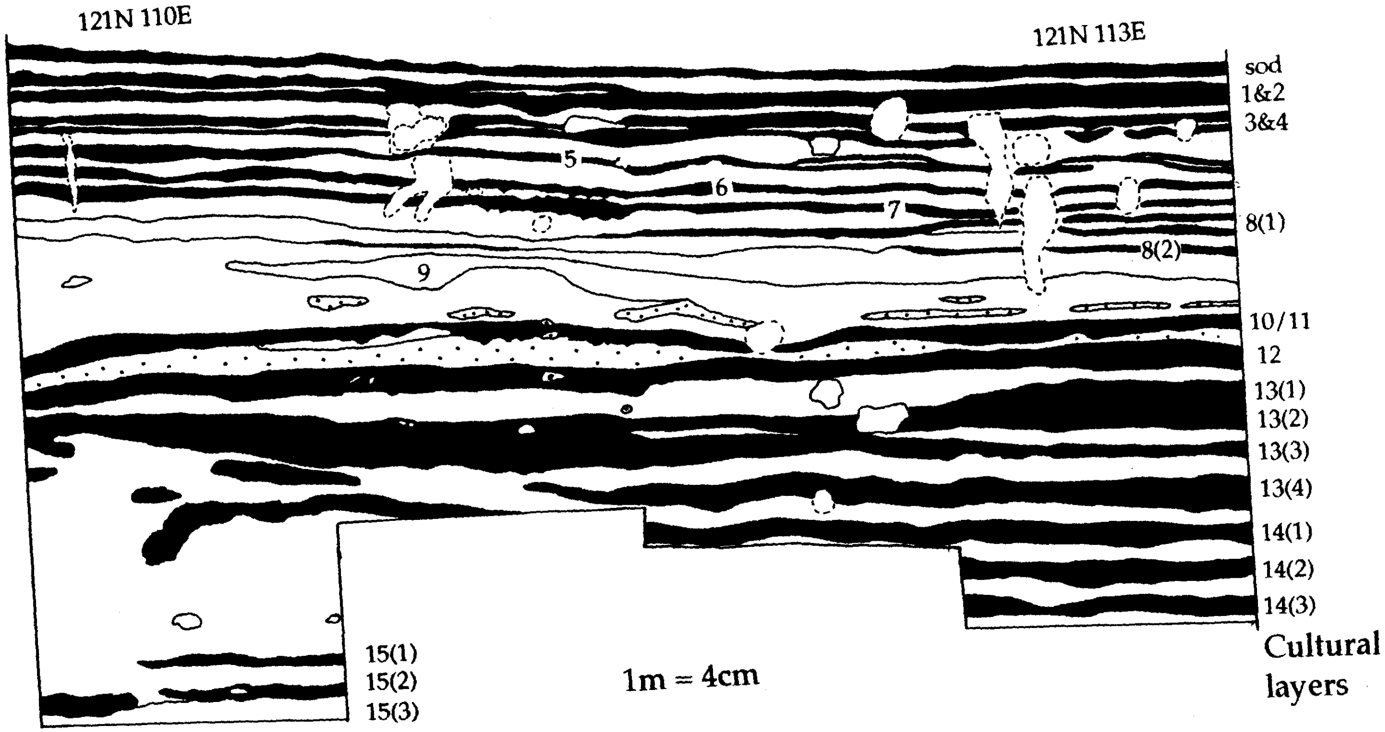


Figure 4.10 Lower Block 121N 110E to 121N 113E, North Wall

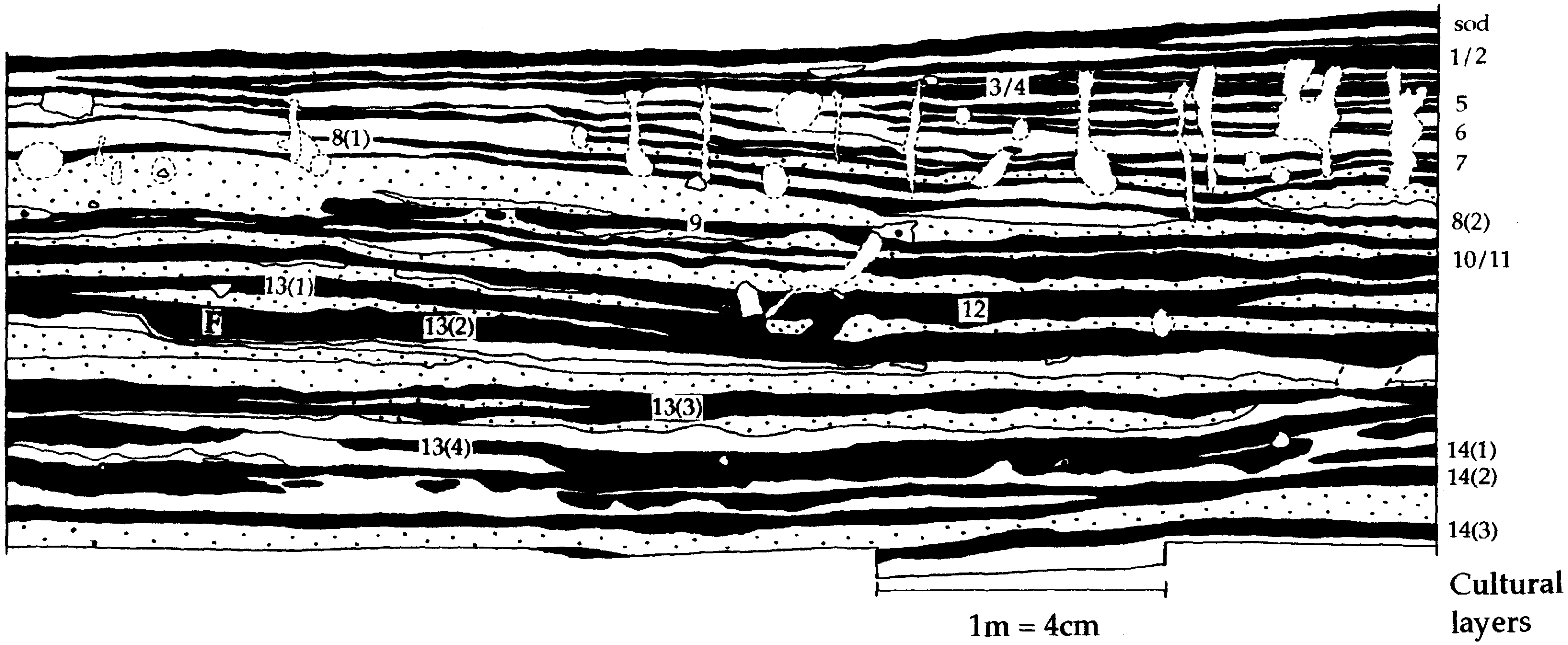
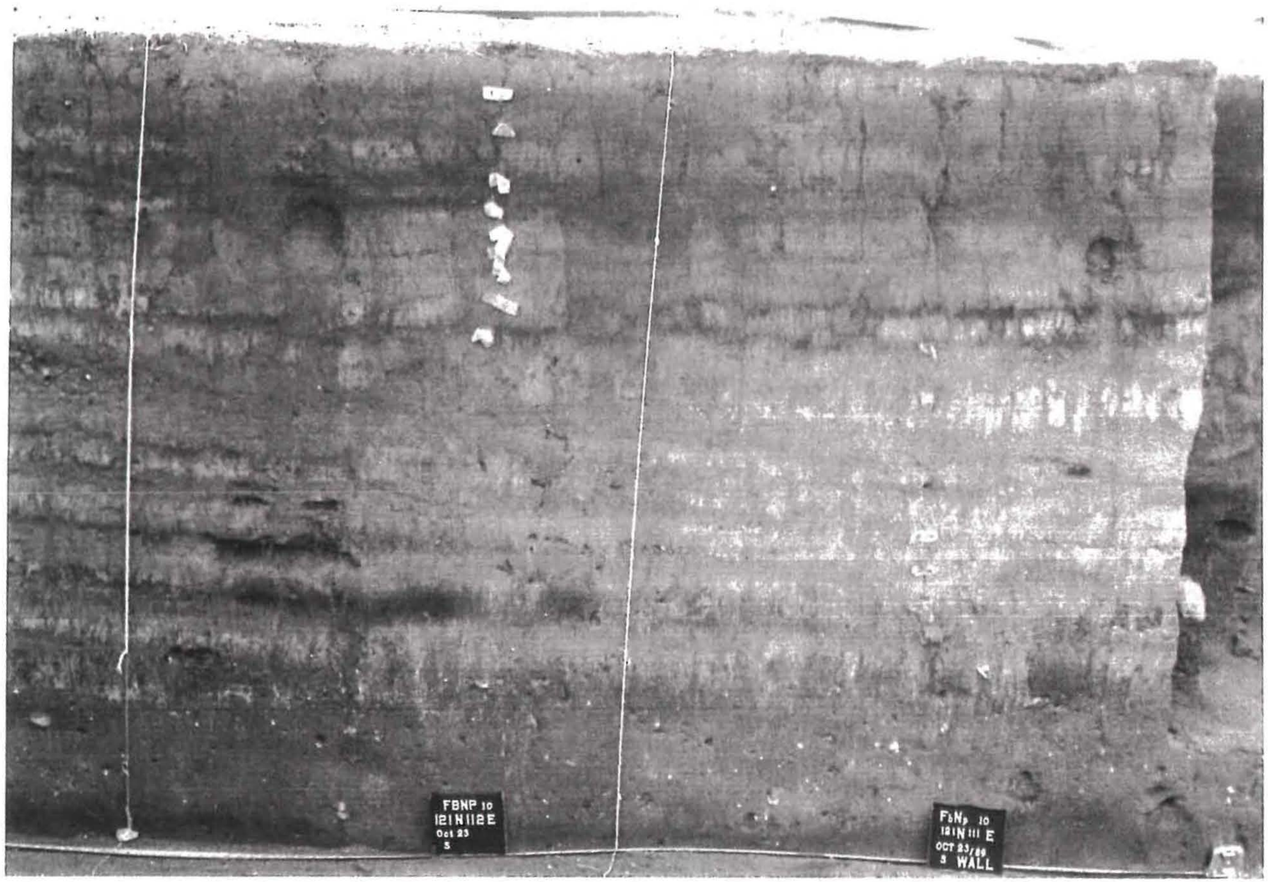
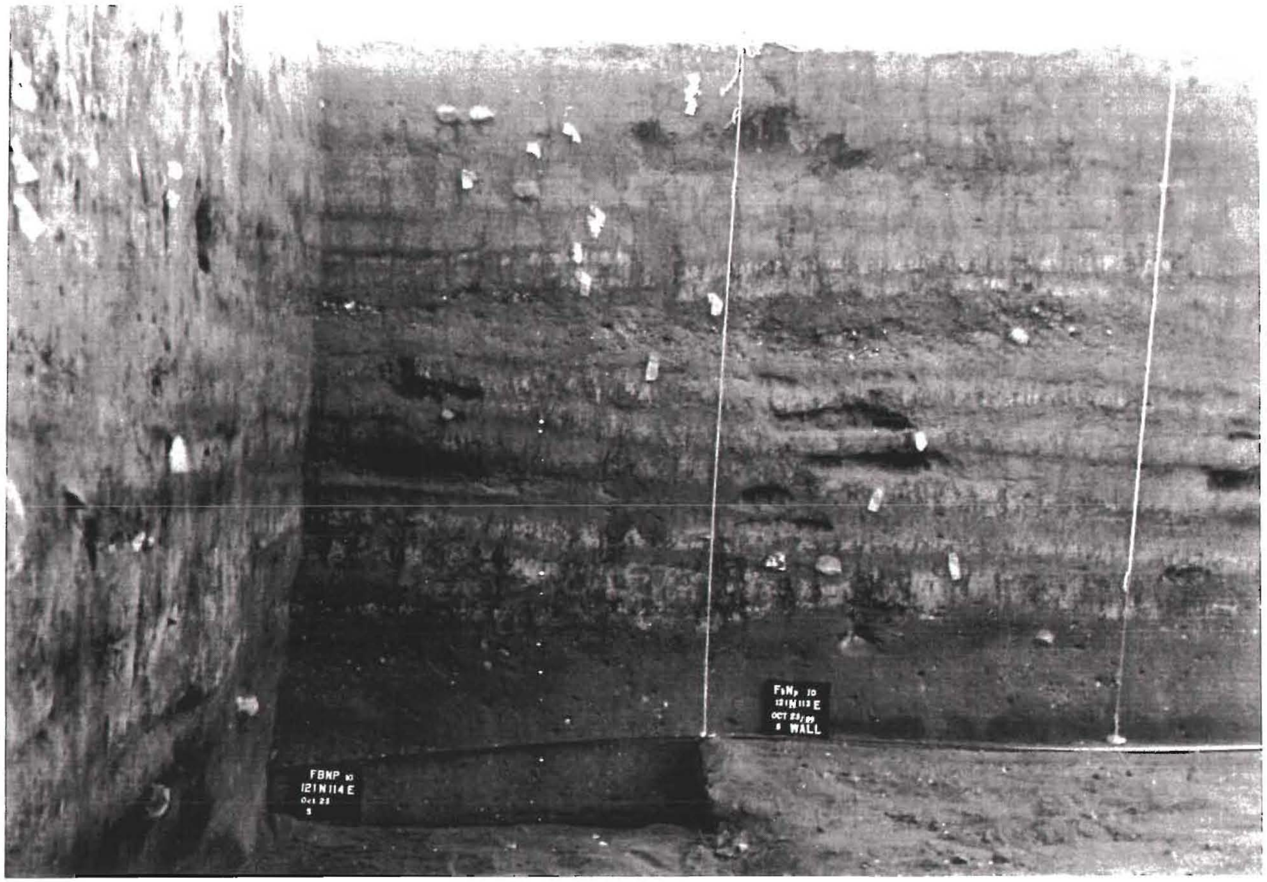


Figure 4.11 East Wall of Block, 121N 114E to 125N 114E



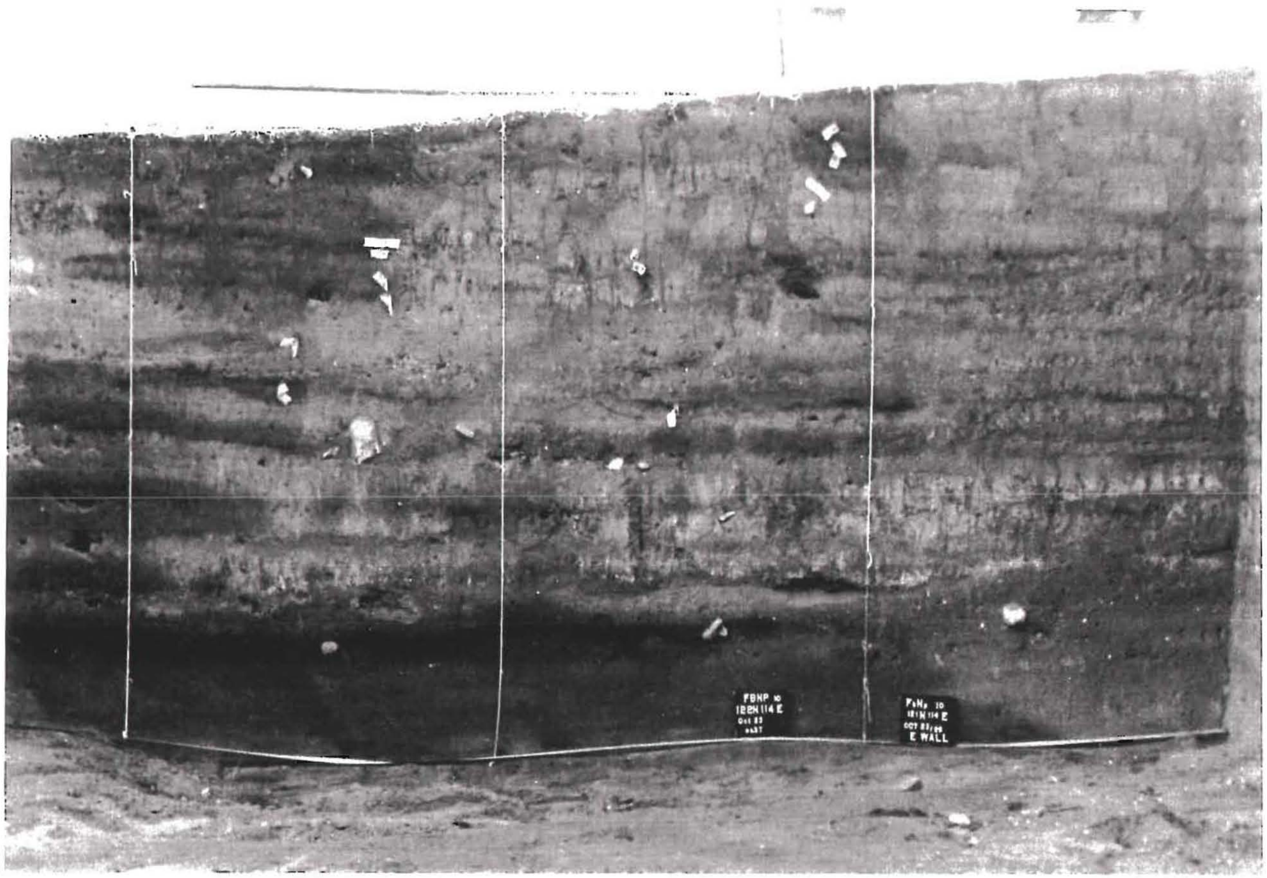
1 m = distance between lines on wall

Figure 4.12 South Wall of Block, Units 121N 111E and 121N 112E



1 m = distance between lines on wall

Figure 4.13 South Wall of Block, Units 121N 113E and 121N 114E



1 m = distance between lines on wall

Figure 4.14 East Wall of Block, Units 121N 114E, 122N 114E and 123N 114E

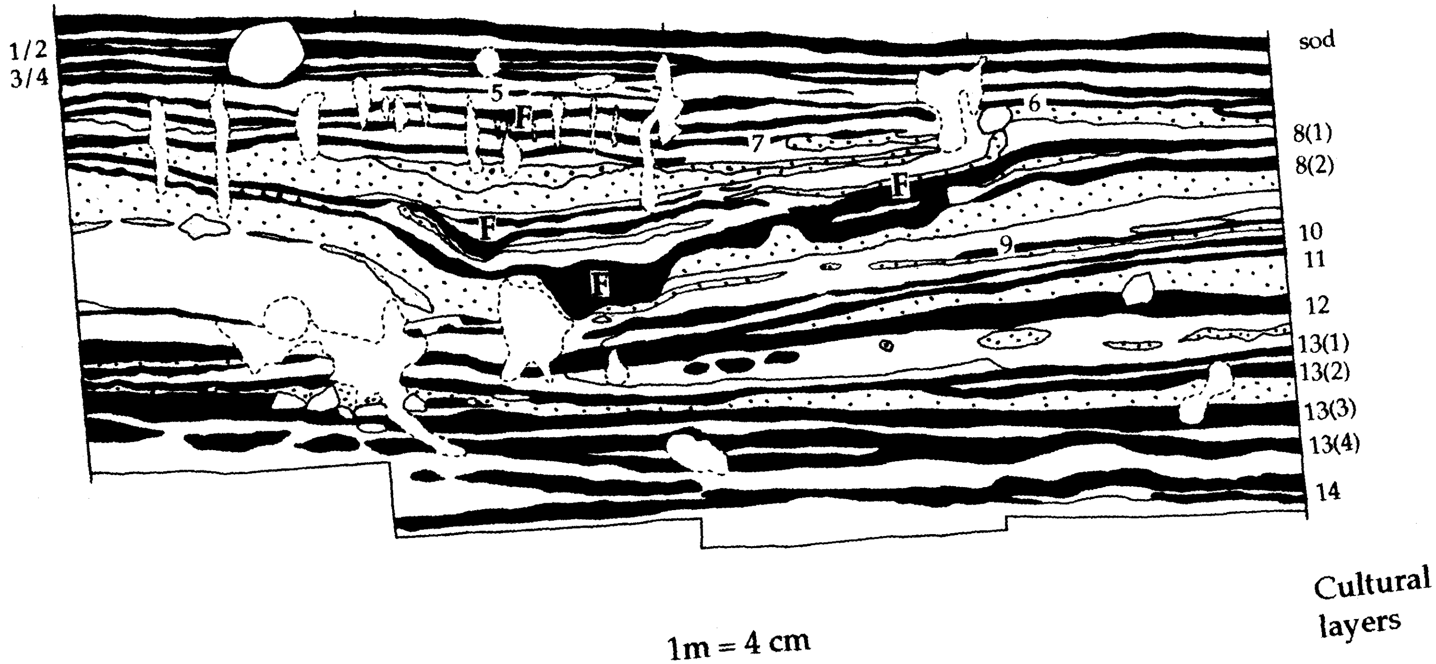


Figure 4.15 North Wall of Block, 124N 108E to 124N 111E

Pithouse cross-section

1 m = distance between lines on wall

Figure 4.16 North Wall of Block, Units 124N 108E, 124N 109E and 124N 110E

downslope and hence produced the natural subdivision of layers in the lower block.

The uppermost sod layer (Ah_1) included a few stone flakes as well as 0.22" calibre shells, bottle caps, a metal tent peg, a metal clip, a plastic barrette and other similar recent post-contact items. The next cultural occupations were denoted by the closely associated layers 1 and 2 (Ahb_3). Layer 1 contained stone debitage and small bone fragments. Layer 2 was slightly darker than layer 1 and splits into two organic bands in some areas. It contained a central hearth in a portion of a stone circle with two Besant point bases. In presumably the same layer the 1982 tests had obtained two Avonlea points and an endscraper. Layer 3 and 4 were represented by Ahb_5 because it split into two layers, and layer 4 farther downslope split into two sublayers. Two triangular points or preform tools were found in these layers with flaked stone and fragmented bone. Layer 5, associated with a thin intermittent organic band, $Ahbu_7$, was a fairly prolific layer. It split downslope into two layers. An endscraper was recovered from a hearth feature, as were concentrations of microflakes. The bone was slightly better preserved than in the uppermost layers and was dominated by bison remains, though some canid remains were also present. Layer 6 (Ahb_8) boasted a substantial stone-filled pit and had many chipped lithics, bone fragments and a few hammerstones. Layer 7(1) and 7(2), represented by Ahb_{10} and Ahb_{11} respectively, also had an abundance of flaked stone materials, bone fragments and some hearth features. None of these upper layers had any remnants of pottery. Also, there were no diagnostic stone tools in layers 3 to 7 inclusive. It may be surmised from the Avonlea and Besant points in layer 2 that this occupation is associated with the Late Precontact period. Layers 3 to 7 may generally be associated with the latter part of the Middle Precontact period. Analysis of this latter set of layers (regardless of lack of diagnostics) and further excavation could produce important information for the poorly known cultures of this timespan.

Layer 8(1), $Ahkb_{14}$, contains no diagnostic lithic artifacts. It has few lithic remains, but contains some bone material. Layer 8(2), $Ahkb_{16}$, splits in one area into two layers. It too has few lithic remains but contains faunal remains, features (including a pithouse) and hammerstones. Layer 9, $Ahku_{18}$, contains very few lithics and a few bone fragments. These may represent redeposited materials or a few remaining materials of an eroded surface. No diagnostic cultural artifacts were found in layers 8(1), 8(2) or 9.

Layer 10 ($Ahkb_{20}$), layer 11 ($Ahkb_{22}$) and layer 12 ($Ahkb_{24}$) contain many faunal remains and lithic materials. The few lithic tools suggest a Hanna configuration designation based on Hanna type haft modification on some reworked points and flake points. Several features are found in these combined layers. Layers 11 and 12 may also have structures outlined.

Layers 13(1) and 13(2), $Ahkb_{26}$, 13(3) and 13(4), $Ahkb_{28}$, also contain many faunal and lithic remains. The few stone points from these layers are McKean Lanceolate type, except for a large, hafted, pointed biface in layer 13(1) which is Hanna-like. Thus, these occupations may be assigned to the McKean configuration. Several features were encountered during the excavation of these layers.

Layers 14(1), Ahb_{30}, 14(2) and 14(3), Ahb_{32}, have faunal remains, but few lithic materials. No features have been noted in these layers. These sublayers were difficult to identify due to the degree of illuviation that occurred in these ancient soil horizons. Thus, analyses will treat these three assemblages as one, unless otherwise specified. There were no diagnostic stone tools from these layers. Layers 15(1) Ahb_{36}, 15(2) and 15(3), Ahb_{38}, contain a few lithics and bone materials. Further excavation of these sublayers should have a good chance of producing diagnostics and spatial patterning, especially for layers 15(2) and 15(3).

4.3.3) Taphonomic and Post-depositional Factors

Taphonomy is the study of post-mortem processes on animal remains. Many post-depositional processes influence the deposited lithic, feature and floral assemblages. These processes bias the archaeologist's perspective of the site (Klein and Cruz-Uribe 1984). Thus, in order to interpret a site some consideration of the degree and types of modifications should be made. It is agreed that more consistent measurements are required (e.g. Marean 1991); however, the small assemblage sample size for each occupation here makes this type of approach ineffective.

The environmental background indicates that the site has temperature and moisture conditions that have varied considerably. This provides a situation, combined with the aerobic conditions of this toe-slope location, for microbial activity (see Carbone and Keel 1985), surface and subsurface water weathering, bioturbation activity and various freeze-thawing effects (Wood and Johnson 1982). Fairly rapid soil development and calcareous soil deposits may have varying effects on assemblage preservation or modification for some layers.

A general approach is taken in assessing taphonomic aspects. Table 4.4 presents the categories of naturally modified bone per layer. It is estimated that 50% to 70% of the bone in all layers is weathered to Stage 1 of Behrensmeyer's (1978) six-stage classification system. This stage includes bone that has limited surface weathering with some longitudinal cracking. Table 4.4 presents the bone assemblage that is further weathered to between Stages 2 to 6. This includes at least an additional 16% of the total bone. The majority of this bone ranges from Stage 3's pronounced cracking with some surface flaking to Stage 4's moderate

Table 4.4 Types and Number of Naturally Modified Bone Material per Layer

Layer	Weathered (> Stage 1)	Gnawed	Root Etched	Multi Alt	Total Bone	%Mod
8(1)	53	2	1	8	257	25
8(2)	14	1	8	1	179	13
9	23	0	2	0	138	18
10	347	1	1	26	2644	14
11	340	1	16	76	3333	13
12	677	7	18	111	6672	12
13(1)	125	0	0	5	1801	7
13(2)	308	16	3	6	3531	9
13(3)	15	1	2	2	351	7
13(4)	70	3	0	2	303	25
14(1)	13	2	0	0	173	9
14(2)	100	2	0	4	498	21
14(3)	66	0	1	0	200	34
15	32	0	0	0	143	22
TOTALS	2183	36	52	241	20223	16

Note: Multi Alt = Multiple Natural Alterations

flaking and cracking with patchy fibrous bone. A few remains are extremely weathered and roughly correspond to Stages 5 and 6 of this classification. They are deeply cracked and have extreme surface flaking or may be crumbling apart.

The faunal and lithic remains from layers 8(1) and 8(2) are coated in calcareous deposits, which are difficult to remove even with washing and scrubbing. These deposits effervesce in acid and are presumably $CaCO_3$. Most of the less coated bone and decoated bones exhibits considerable weathering. Table 4.4 indicates the high percentage of weathered bone at 25% for layer 8(1). Layer 8(2) has 13%, which is slightly less than the 16% average of all layers. Much of the weathering from these layers is in the form of smoothed and degenerated surfaces (Stages 4 to 6), likely caused by water erosion and exposure. The predominance of coarser alluvial and colluvial hillwash sediments found above, below and between the two main sublayers of layer 8 may indicate greater.energy hillslope processes. This may suggest that these processes resulted in greater initial bone weathering. However, the somewhat finer soils in layer 8 and the layer's appropriate depth for redeposition of leached minerals (primarily $CaCO_3$) from the upper layers may provide conditions for protection from further chemical weathering (see White and Hannus 1983: 318, 321).

Layer 9 was intermittent and also contained calcareous-coated bone materials which are smaller and fragmentary. This layer has 18% of its faunal remains moderately weathered (Stages 4 and 5 primarily). It is possible that these remains were derived from other material upslope and had been redeposited during a period of apparently active erosion and deposition. This layer is in the middle of a thick deposit of colluvial-dominated sediments.

Layer 10 contains weathered bone, but a bison skull and bison horn cores, fetal bison remains, bird and rodent remains are also preserved. There were some clay/silt lamellae deposited above and in the upper portion of layer 10. These lamellae may have helped preserve some bone, in addition to the calcareous coatings of material. Weathered bone, 14% of all bone in the layer, is slightly below average of all the layers.

Layers 11 and 12 have relatively good preservation (about average), and materials are also coated in calcareous deposits. Root etching is more prevalent in these layers - at least 2% to 4% of the weathered material. This suggests a relatively stable period which allowed vegetation to become well established.

Layers 13(1), 13(2) and 13(3) all have low weathering when compared to other layers (between 7% to 9% of the faunal materials). There is also less calcareous coating of materials from these layers. Layer 13(4) contrasts, with 25% of the material being weathered. It is least coated with calcareous deposits and is associated with coarser soil particle-sizes that may reflect higher energy deposition processes.

Layer 14(1) has less weathering of bone materials, which are less coated in calcareous deposits. Layers 14(2), 14(3) and 15 are heavily weathered, 21%, 34% and 22%, respectively. Most are between weathering Stages 4 to 6. Some remains are smoothed over the surfaces, and others are disintegrated or split into fragments. This seems to correspond with the coarser alluvial and colluvial sediments and probably more active surfaces at those times.

The greater amount of weathering of bone in some layers appears to correspond with coarser sediments. Presumably these deposits required greater water transport energy to move the larger soil particle-sizes. This increased energy combined with coarser sediment's erosive capabilities (for weathering bone on or below the surface) may be reflected in this further weathering of the associated faunal assemblages. Thus, increased slope angle and channelization for different paleosurfaces may have influenced weathering of the faunal assemblages. Overall, higher percentages of weathered bone, coarser soils and paleotopographic maps may be combined as post-depositional indicators for each layer. These indicators may be used to explain mixing, absence of materials, and potential modifications of faunal, lithic and floral remains. The degeneration of bone, as indicated by the sizes and unidentifiable materials, is also pertinent to this assessment. However, unidentifiable remains are discussed in Chapter 6, and the burned and unburned materials are presented in maps in Chapter 7. These, combined with the above information, can help assess whether bone degeneration in different layers is primarily due to natural or cultural influences.

Another important modification to these assemblages includes rodent burrowing. Several rodent burrows were noted during excavations and may be seen in the profiles (see Figures 4.13, 4.14 and 4.15). Chapter 6 discusses the rodent remains found in each layer. The greatest number of rodent bones represented, associated with layer 12, corresponds with the second highest number of gnawed bone remains (Table 4.4). However, this also corresponds with the highest number of canid bones. Layer 13(2) has the highest amount of gnawed remains, which corresponds with the second highest number of rodent remains and a moderate amount of canid remains.

It is difficult to differentiate canid and rodent gnawing due to the subsequent weathering of the bones; however, there are some carnassial tooth punctures in long bones which indicate canid activity (Figure 4.17). Also, there are deep broad parallel grooves which indicate canid gnawing (Figure 4.18). However, there are also some multi-faceted gnaw marks which indicate rodent gnawing. Gnawing occurs in layers 12 and 13(2) to the greatest degree, but most other layers have some evidence of this. Gnawing evidence is considered underrepresented because of the difficulty in identifying such marks on weathered bone surfaces. A synthesis of each cultural layer's natural modification factors is reviewed in the Chapter 6 discussion in order to contrast this with cultural bone modifications.

4.4) Chronometric Dating

Chronometric dating is the quantitative measurement of time with respect to some given scale, such as calendar years or radiocarbon years (Michels 1973:14). At the Redtail site radiocarbon samples and thermoluminescence samples were submitted to obtain chronometric dates on the layers associated with the McKean tradition.

There is a considerable range of field collection, laboratory methods and reporting procedures that limit comparability of radiocarbon dates (Kra 1986:765-775; Ottaway 1986: 732-738). Archaeology has been slow in recognizing that there should be limits to comparisons and a consistent reporting of results. The

Figure 4.17 Carnassial tooth puncture marks on the proximal end of a canid humerus

Figure 4.18 Canid gnaw marks on the proximal portion of a bison mandible

recommendations by Stuiver and Polach (1977:362-363) and Kra (1986:766-767) are considered in the presentation of radiocarbon dates.

Thermoluminescence dating is an another chronometric technique for directly dating many artifacts that have been purposely or inadvertently heated enough to reset electron collecting "traps" in some materials. This method was to be used on some fire-broken rock and hearth-baked soil samples. Problems were encountered with this technique and they will be discussed briefly for future considerations.

4.4.1) Radiocarbon Dating

Seven bone samples were submitted for radiocarbon dates from the Redtail site. Samples were taken from cultural layers 11, 12(1), 12(2), 13(2), 13(4) and 15. The object was to obtain dates from good association with the McKean diagnostics. The provenience of samples is depicted in Figure 4.19.

Three radiocarbon samples was submitted after the 1988 field season to confirm the McKean Lanceolate point and probable Hanna point associations, and to date the lowest layer of the site. Another set of four samples were submitted in the winter of 1991. The δ13 values were measured for this second set of dates. However, for consistency with other date comparisons they remain uncorrected. The δ13 values are presented with the other radiocarbon date information in Table 4.5 and may be used to evaluate the bone sample dates from this site overall.

The uppermost of these dates, 3480 ±80 rcy B.P. (S-3372), was obtained from a weathered bison femur from layer 11. It was associated with a nearby probable Hanna type point body (catalogue # 4952). A pot-pourri of bison scapulae, vertebrae, rib and long bone fragments from the upper part of layer 12, produced a date of 3470 ±80 rcy B.P. (S-3373). This was associated with a large side-notched biface and two small side-notched/stemmed points (see catalogue

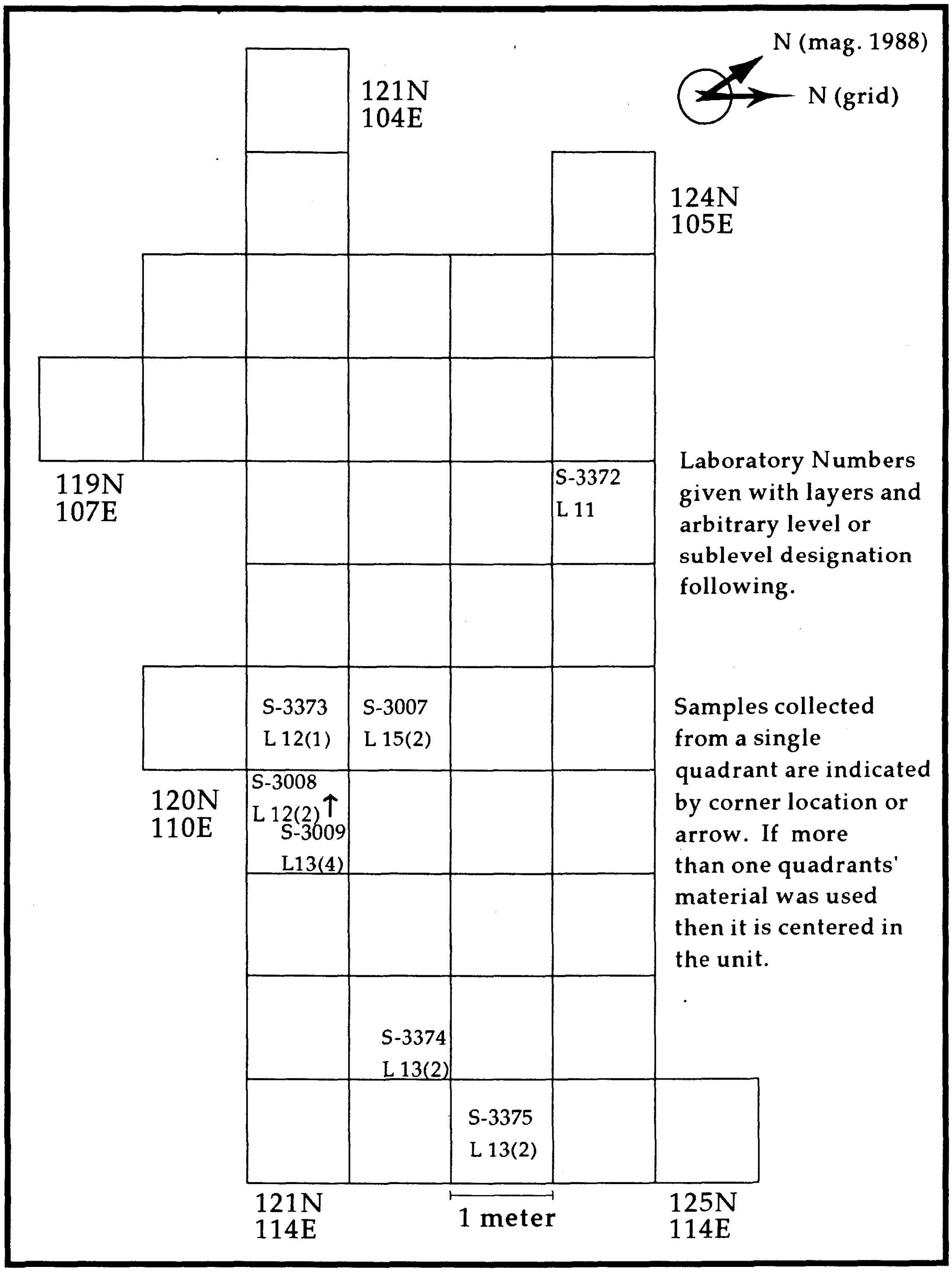


Figure 4.18 Locations of Radiocarbon Samples

Table 4.5 Radiocarbon Dates from the Redtail site

Cultural Layer	Unit	Quad(s)	Diagnostic/ Association	Laboratory Number	Radiocarbon Age (B.P.)	δ13	Calibration Sources
11	124N 108E	SW	Hanna point	S-3372	3480 +/- 80	-18.8	Stuiver and Becker 1986
12(1)	121N 110E	All	Midden Area	S-3373	3470 +/- 80	-18.8	Stuiver and Becker 1986
12(2)	121N 111E	SW	Hanna points	S-3008	3660 +/- 75	NA	Stuiver and Becker 1986
13(2)	123N 113E	NE	McKean Lanc.	S-3374	3860 +/- 70	-18.3	Stuiver and Becker 1986
13(2)	123N 114E	All	McKean Lanc.	S-3375	3880 +/- 70	-18.9	Pearson and Stuiver 1986
13(4)	121N 111E	NW	McKean Lanc.	S-3009	4280 +/- 80	NA	Pearson et al. 1986
15(2)	122N 110E	All	Stone Flakes	S-3007	5010 +/- 90	NA	Pearson et al. 1986

Lab Number	Calibration of Dates 2 sigma/95.4% area enclosed age span (with intercepts)	Probabilities (2 sigma/95.4% area enclosed) age range (relative area under distribution)
S-3372	3981 (3811, 3794, 3776, 3773, 3760, 3749, 3724) 3555 B.P.	3982-3554 (1.00)
S-3373	3979 (3757, 3753, 3720, 3709, 3703) 3549 B.P.	3980-3937 (.05), 3932-3552 (.95)
S-3008	4240 (4058, 4052, 4039, 4034, 3983) 3780 B.P.	4243-3826 (.98)
S-3374	4419 (4341, 4332, 4296) 4155 B.P.	4421-4142 (.96), 4115-4089 (.03)
S-3375	4522 (4402, 4372, 4347) 4091 B.P.	4522-4483 (.04), 4455-4131 (.93), 4115-4091 (.02)
S-3009	5043 (4860) 4574 B.P.	5052-4801 (.66), 4777-4603 (.30), 4593-4563 (.02)
S-3007	5949 (5735) 5589 B.P.	5942-5591 (1.00)

numbers 2795, 2788 and 2789). A combined bone sample from the lower part of layer 12, in the unit adjacent to the above date, dated 3660 ±75 rcy B.P. (S-3008). This sample was associated with two reworked Hanna points (catalogue numbers 2716 and 2718). Two samples were taken from adjacent units in layer 13(2) downslope. The first of these, 3860 ±70 rcy B.P. (S-3374), was produced primarily from bison long bone fragments, but also from some rib, vertebrae and scapula fragments. A fragmented bison radius produced a date of 3880 ±70 rcy B.P. (S-3375). These samples are both adjacent to a McKean Lanceolate type point (catalogue #353) and a possibly Duncan point base (catalogue #276). A date of 4280 ±80 rcy B.P. (S-3009) was obtained on a weathered bison humerus closely associated with a McKean Lanceolate point (catalogue # 2717) and near another (catalogue #1964) at the bottom of layer 13(4). The deepest radiocarbon sample produced a date of 5010 ±90 rcy B.P. (S-3007). This was taken on bison long bone fragments associated with some stone flakes in layer 15(2). These dates are calibrated in Chapter 8 with the other site comparisons.

4.4.2) Thermoluminescence Dating

Thermoluminescence (TL) dating is based on the measurement of light emission in excess of the incandescent glow produced when an inorganic, electrically non-conductive material is heated. An archaeological sample must be heated to such a temperature so as to remove trapped electrons within the material. The trapped electrons store energy. These electrons are emitted and the energy released measured on a "glow curve". The amount of energy measured is converted to the passage of a given amount of time. Dating the material requires measuring background radiation from the area. With this information, it can be determined whether the radiation history has been average or not - and thus whether the dislodging of electrons has been going on at a normal or accelerated rate. Hence, its age of production or use can be determined (Wagner. *et al.* 1983: 1-47).

The benefits of TL dating are: 1) they are absolute dates not requiring calibration; 2) they cover a considerable time span (50 years to 500,000 years); and, 3) much of the material being dated is an actual artifact. A problem with this technique is the stringent sampling methods which require the recording of the background conditions of the sample and surrounding soil, including water content and local variations in radiation fluctuations. Pottery has been the most common material for use in TL dating, as the firing of the pottery produces a definite heating event that removes electrons from "traps" within the pottery. Other materials that may be dated with this technique, given the proper conditions, includes fire-broken rock, baked hearth clay, heat-treated chalcedonies and even some wind-blown loesses and calcite deposits (Parkes 1986: 36-60).

Guidelines for collection of samples followed those utilized by the University of Durham's TL Dating Laboratory (Baillif 1988: 4-8). Although the dates submitted followed the preliminary "survey dating" procedure, a more intensive "dating program" may be possible in the future, given the funds and more in-depth field procedures. This approach included collecting soil samples from close association with the TL sample, and soil samples from 50 cm above and 50 cm below the sample. The TL samples were exposed to sunlight as little as possible. They were enclosed in black plastic photography bags and metal tins or boxes as soon as they were removed.

Three TL samples were submitted for dating to the University of Durham's TL Dating Laboratory. Two of these were fire-broken rock and one was a hearth-baked soil. Both rock samples could not be dated because they were granites and had variability of radioactive material in the body of the rock.

At the Redtail site, and many other sites on the Plains the most recognizable fire-broken rocks are granite and other metamorphic type rocks. Fire-heated sedimentary rocks are preferred, but it is usually more difficult to determine the extent to which they have been heated. The third sample took longer to determine that it was undateable. It seems that it was either not heated hot enough, or the soil was too porous to trap the electrons efficiently. The better soils for TL dating obviously have a higher clay content, while this soil was a hard loamy sand, somewhat cemented by calcareous deposits. This may also indicate that this hearth contained smaller, low heat, longer duration fires. Likely, this is the case for many hearths on the Plains. At least some lessons were learned from these samples. Some recent experimentation with silt-based heated soil samples at the Durham TL Laboratory have apparently made some progress in dating more porous soils. This technique has proved successful for Late Precontact period sites and can perhaps prove useful for earlier occupations too.

4.5) Discussion

In the 1988 and 1989 field seasons about 77 m^3 were excavated at the Redtail site (FbNp-10). A central block area, 9 m by 4 m, had expanding units up and across the 4.5° or 8.4% slope. Natural layers were excavated; some were separated into arbitrary sublevels. Quadrant provenience (50 cm by 50 cm) was obtained for each level and point provenience measurements were taken on larger and identifiable items from a southwest corner unit datum. All unit data were connected to the site datum. Systematic 25% and 50% fine-screen samples were taken in 1988 and 1989, respectively. Flotation samples were taken judgementally from the many features encountered.

Thirty-nine basic natural strata are identified at the site. Many of these were buried soil horizons or remnants thereof. The soil profile is generally a weakly developed Chernozemic accumulation. Soil layers have accumulated at the toe of this slope by colluvial, alluvial and surface wash processes. This has produced a mixed accumulation of sands, loamy sands and sandy loams with influxes of gravel and thin clay lamellae. Paleotopographic maps and taphonomic data help to reveal the sequence of horizon developments and how they relate to each other. This information will be important when it is compared to cultural material concentrations.

There were 15 main cultural layers with at least 23 assemblages identified within these during the field seasons. The upper seven layers are summarily discussed, noting that layer 2 contained the only diagnostic items from these layers: Avonlea and Besant projectile points. No pottery was recovered from any of these upper layers, perhaps indicating that layers 3 to 7 were occupied during the Late Middle Precontact times (e.g. greater than 2,000 rcy B.P.).

Seven radiocarbon dates were obtained from bone samples. The oldest of these (from layer 15) was 5010 ±90 rcy B.P., and though closely associated with flaked stone material, there were no diagnostic items. Dates from layer 13, identified with McKean lanceolate type points, spanned from 3860 ±70 rcy B.P. and 3880 ±70 rcy B.P. in layer 13(2) to 4280 ±80 rcy B.P. in layer 13(4). A date from the bottom part of layer 12 was 3660 ±75 rcy B.P. Two dates from layer 11 and 12(1), respectively, were 3480 ±80 rcy B.P. and 3470 ±80 rcy B.P. These latter two layers and dates were associated with Hanna type diagnostics.

Though three TL samples were submitted to the University of Durham, England, none was successfully dated. There was one each from layer 8, layer 12 and layer 13(2). It is noted that fire-broken rock samples used for such purposes should be sedimentary and should indicate extreme heating. Also, baked hearth soils should be sampled only if the soil has high clay content and shows indications of high and prolonged heating.

CHAPTER 5

Redtail Site Artifacts

5.1) Introduction

The majority of artifacts from layers 8 through 15 are chipped lithic debris and tools. There are 38 chipped stone tools, including 11 projectile points, 5 large hafted and/or pointed bifaces, 5 miscellaneous bifaces, 2 hafted pointed unifaces, 7 other notched and unifacially retouched items and 9 marginally retouched stone tools. Fifty cores are also identified from these occupations.

There are also 14 large, granular stone tools. These include two stones, with smoothed areas that were possibly used in grinding or crushing softer materials. Three other large stone tools functioned as combination anvils and hammers. Three tools appear to be solely hammers, and two others are anvils. Two of the three chopper tools also functioned as hammers. One coarse conglomertic fragment has an abraded groove worn into it. Many other granular rocks and limestone slabs are distributed throughout these layers. Some of these are identified as fire-broken rock. Other rocks may also have been used for supports, anchors or were used minimally as heat retaining rocks.

Most of the lithic material used at the site is found locally (see Finnigan *et al.* 1985: 9-3 to 9-7; Johnson 1986). However, a few flaked materials may have been transported from source areas as far away as South Dakota/southern Montana (e.g. Tongue River silicified sediment) and perhaps North Dakota (if the brown chalcedony found is Knife River flint).

Only a few specimens can be identified as possible bone tools. These are discussed summarily toward the end of this chapter. The following section discusses the methods and approaches used in analyzing the various artifact categories in this chapter.

5.2) Artifact Analyses Methods

The definitions for metric and nonmetric attributes of flaked lithic materials used here are based primarily on Binford (1963), Finnigan *et al.* (1985) and Reeves (1970). Some additional definitions and perspectives are incorporated from Brumley (1975), Bonnichsen (1977), Hayden (1979) and Quigg (1986). Specific definitions are explained in the discussion of each artifact group. The lithic material identifications are based on definitions from Finnigan *et al.* (1985: 9-3 to 9-7) and Johnson (1986).

The approach taken in stone tool identifications incorporates aspects of function, reworking and discard (see Crabtree 1972), and is based on works by Bradley (1975: 5-13), Bonnichsen (1977), Ericson (1984: 1-9), Flenniken (1985: 265-276), Keyser and Fagan (1989), Knight and Keyser (1983), and Towner and Warburton (1990: 311-321). Basically, it utilizes a lithic reduction model to view lithic remains at different stages of technological sequences (e.g. Ericson 1984: 1-9). The perspective taken thus recognizes the use-life of tools and considers this in typing specimens morphologically.

Ericson (1984: 4) outlines some indices for lithic production analysis. These are all compared by percentages. A debitage index is derived by dividing the number of debitage, excluding retouch/sharpening flakes, by the total tools and debitage. This indicates the relative occurrence of the general production of chipped lithic tools compared to the use of tools (as reflected in the identified tools and sharpening retouch). A cortex index compares the number of decortication debitage to total debitage, excluding retouch/sharpening flakes. This generally reflects the amount of import of raw material (primary cores) to the site. A lower cortex index with a high debitage index may also reflect import of secondary cores, preforms and blanks as opposed to primary cores. A core index compares the number of spent cores to total cores. This generally reflects the amount of secondary core reduction, and it may reflect the duration and/or season of occupation. Ericson (1984: 4) also suggests the use of a biface index. Since biface thinning flakes were not specifically distinguished due to time constraints, only a "rough" equivalent may be used. A rough indicator of production of blanks, preforms and biface tools may be indicated by using flakes between 5.7 mm and 50 mm in size. These flake sizes may also reflect production of flakes for expedient use. However, the lack of use-wear on these specimens and the great number of flakes overall suggest that they are more reflective of a reduction sequence.

The general debitage is differentiated into flakes, shatter and bipolar flakes as defined by Finnigan *et al.* (1985: 9-7 and 9-8). All lithic materials were also divided into five size categories (<2.8 mm, 2.8 mm to 5.7 mm, 5.7 mm to 12.5 mm, 12.5 mm to 50 mm, >50 mm). These size categories were part of the Rafferty Dam cataloguing program (Ferris 1989). Ferris modified this program by adding sublevel designations, for use in cataloguing all the materials in this present study. Rough parallels are drawn for lithic analyses from these sizing categories without identifying all the retouch/resharpening flakes specifically. This is debatable, but sizing categories do provide a consistent measure for comparison of lithic debris between occupations. It may be assumed that most if not all of the flakes in the <2.8 mm and 2.8 mm to 5.7 mm size categories are either from resharpening or from initial edge retouch in making tools (e.g. Reeves 1970: viii). All debitage, flakes or shatter, smaller than 5.7 mm may be considered to equate with microdebitage, roughly the same as <6 mm used by Finnigan *et al.* (1985: 9-9). These microdebitage primarily represent "spontaneous" retouch from general chipped lithic reduction or use of stone tools in working hard materials. The larger flake sizes, 5.7 mm to 12.5 mm and 12.5 mm to 50 mm, may represent thinning flakes from biface or other shaped tool manufacture, as well as some flake's produced for expedient use. The largest flakes, 25 mm to 50 mm and >50 mm, may more likely reflect the primary and secondary flakes removed from cores at the site. The presence or absence of cortex is recorded for all debitage. This roughly indicates primary and secondary flakes and shatter. Shatter generally represents core reduction debris. Quigg (1986: 116) suggests that the use of hard hammer percussion produces more shatter than flakes in core reduction. Inversely, the dominant use of soft hammer percussion may produce more flakes. The flake to shatter ratios will be compared between layers.

A variety of core types are differentiated. These include prepared bifacial and unifacial cores, unprepared cobbles, split pebble and split cobble cores, as well as bipolar, reduced and fragmented cores (defined after Finnigan *et al.* 1985: 9-8 to 9-9). A larger amount of cortex represented on flakes and shatter in each layer may indicate the importation of unprepared local lithics to the site for reduction.

The modified lithic tool categories include bifaces (projectile points, preforms, large hafted and unhafted tools), unifaces (pointed notched forms, gravers, notched forms and scrapers) and marginally retouched tools. Each grouping is defined in the introduction for each tool type section. These are generally morphological descriptive groupings of tools for comparability and simplicity. However, the various tools are also discussed from the perspective of general flaking characteristics and possible use(s) and reuse(s), noting rejuvenation and reworking. A 10x geological hand lens was employed to view flaking and wear characteristics. Flake definitions and use-wear descriptions and interpretations are gleaned from Bonnichsen (1977), Hayden (1979), Odell (1977), Reeves (1970), Semenov (1964: 16-21), Shea (n.d.: 1-33), Tringham *et al.* (1974: 171-195) and Vaughan (1985).

Coarse/granular stone tools are measured and analyzed according to attributes and definitions in Finnigan *et al.* (1985: B-15 to B-20) and Quigg (1986). These tools are described morphologically, and the functional possibilities are also discussed.

Though many of the coarse rock and other cobbles and boulders did not display obvious modifications, several are fire-broken. The fire-broken rock is differentiated into <5 cm and >5 cm sizes (after Quigg 1986: 114) so that some relevant intersite comparisons may be made.

5.3) Fire-Broken Rock

Fire-broken rock (FBR) is present in layers 8 to 14 but not 15. Frequencies and weight of FBR for each layer are provided in Table 5.1. Layers 11, 12 and 13(2) obviously have the highest amount of this material. The two size categories, <5 cm and >5 cm, are used to relate to intensity of FBR reduction. This may reflect increased processing, cooking and perhaps duration of the occupation. These activities may be reflected by varying relative numbers and

Table 5.1 Fire-Broken Rock Frequencies and Weights per Layer

Layer	Freq. (<5 cm)	Freq. (>5 cm)	Wt.(gm) (<5 cm)	Wt.(gm) (> 5 cm)	Total Freq.	Total Wt.(gm)
8 (1 & 2)	1	1	25.8	871.7	2	897.5
9	68	2	175.2	329.6	70	504.8
10	13	11	127.6	3334.0	24	3461.6
11	74	40	1011.7	12412.9	114	13424.6
12	4528	253	9588.2	67154.4	4781	76742.6
13(1)	682	41	1655.5	9028.6	723	10684.1
13(2)	212	43	957.7	14478.9	255	15436.6
13(3)	50	28	599.1	4506.2	78	5105.3
13(4)	9	10	554.6	2202.2	19	2756.8
14	36	7	61.2	5442.7	43	5503.9
15	0	0	0	0	0	0.0
TOTALS	5673	436	14756.6	119761.2	6109	134517.8

weights of the FBR size categories. An average weight of each size category will also be used to compare FBR utilization.

Ethnographic information on the uses of rock, that results in FBR, focus on stone boiling and roasting in cooking meals or bone grease extraction (see Verbicky-Todd 1984: 177-183). Some work in northern Sweden is beginning to associate rock material types to different functions, and one primary function is the use of rock for improved heat retention in cold seasons (Olaf Westfall 1988, personal communication). Any or all of these uses could have produced FBR at the Redtail site.

The total frequencies and weights are very high in layer 12 (Table 5.1). High moderate amounts of FBR are present in layers 11, 13(1) and 13(2). Some less moderate amounts of FBR are present in layers 10, 13(3), 13(4) and 14. Layers 8 and 9 have few FBR, and layer 15 has none. FBR may be less heavily utilized in the layers with moderate to very few small FBR, or perhaps it was used in a different manner that did not cause disintegration (such as heat retention). Fire-broken rock material variations between assemblages does not seem to reflect size ratio differences.

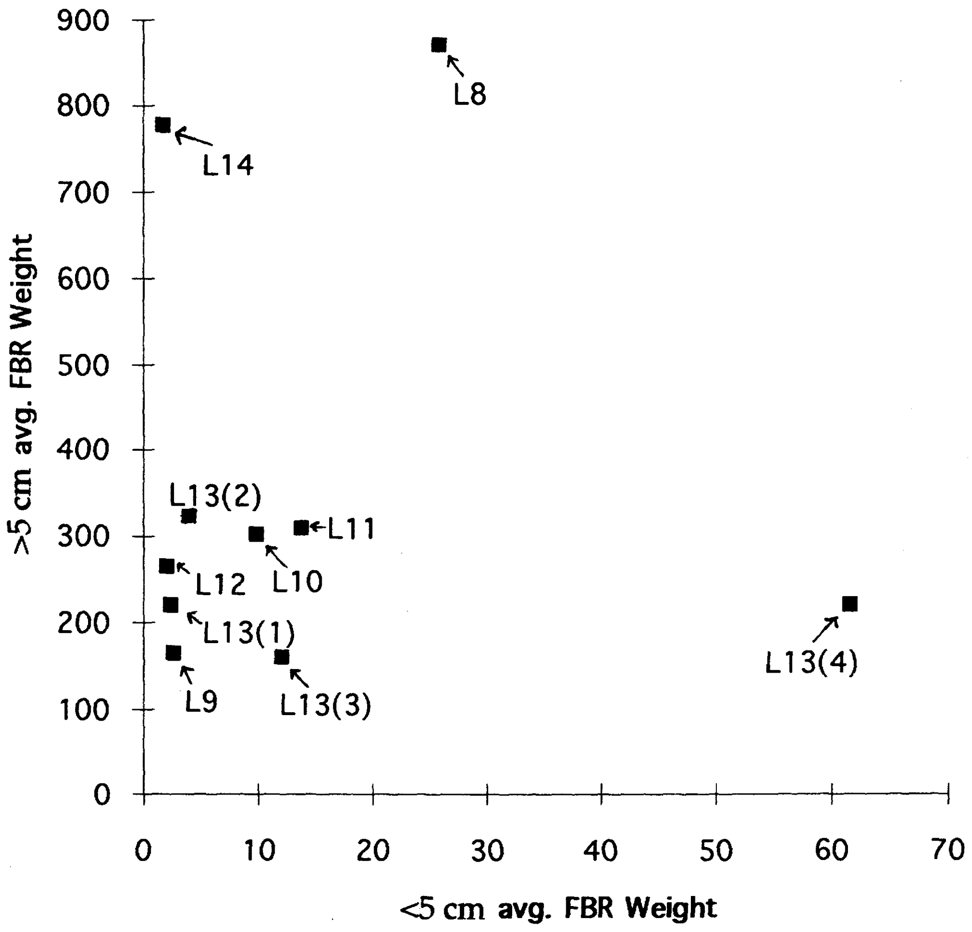
In Table 5.2 the average weights for each size category are presented for each layer. These resulting values of the large size categories' average to the small size's average are plotted in Figure 5.1. Most layers cluster between the large size categories' average weights of about 160 gm to 337 gm. Exceptions to this cluster are layers 8 and 14, which have average weights of 778 gm and 872 gm, respectively. These larger average sizes in these layers correspond with the least plentiful small FBR category above.

The small size category average weights cluster between 1.7 gm and 4.5 gm. This cluster includes layers 9, 12, 13(1), 13(2) and 14. Another cluster may include layers 10, 11 and 13(3), which range between 9.8 gm to 13.7 gm. Two

Table 5.2 FBR Average Weights per Size Category

Layer	<5 cm	>5 cm
L8	25.8	871.7
L9	2.6	164.8
L10	9.8	303.1
L11	13.7	310.3
L12	2.1	265.4
L13(1)	2.4	220.2
L13(2)	4.5	336.7
L13(3)	12	160.9
L13(4)	61.6	220.2
L14	1.7	777.5

Figure5.1 FBR Weight Relations



outliers, layers 8 and 13(4), have average weights of 25.8 gm and 61.6 gm, respectively.

When these clusters are compared to frequency, weight and average weight ratios a more intense/prolonged use may be associated with layers with the smaller (reduced) averages and greater amounts of the small sized FBR. Thus, intense and/or prolonged use is indicated for layers 12, 13(1) and 13(2). Layer 9 has a moderate amount of FBR with a moderate reduction. Layer 14 has a relatively low amount of FBR but it is considerably reduced or well utilized. Lower to moderate amounts of FBR and moderate usage is suggested for layers 10, 11 and 13(3). Less FBR and low usage is indicated for layers 8 and 13(4).

A cross-section of the coarse lithic materials used in each layer is presented in Table 5.3. Granite was the most common rock. Schist, basalt, gabbro, andesite, rhyolite and gneiss were present to a lesser degree. Other infrequent materials included diorite and shale, probably because they are not as plentiful locally. The miscellaneous category was dominated by limestone and siltstone.

Table 5.3 Percentages of Rock Material Types per Layer

Lay	Grn	Sch	Bslt	Gab	And	Rhy	Gnss	SS	Dir	Shl	Misc.
8	100	0	0	0	0	0	0	0	0	0	0
9	100	0	0	0	0	0	0	0	0	0	0
10	79	14	7	0	0	0	0	0	0	0	0
11	45	12	0	5	0	2	1	0	0	0	35
12	90	2	0.3	3	1	0.6	0.6	0	0.3	0.2	2
13	90	2	0	0	2	0	1.6	0.4	0	0	4
14	81	0	6	0	0	0	0	0	0	0	13
15	0	0	0	0	0	0	0	0	0	0	0

Abbreviations: Lay=layer; Grn=Granite; Sch=Schist; Bslt=Basalt; Gab=Gabbro; And=Andesite; Rhy=Rhyolite; Gnss=Gneiss; SS=Sandstone; Dir=Diorite; Shl=Shale; Misc.=Miscellaneous.

5.4) Chipped Lithic Debitage

The chipped lithics are dominated by chert materials in all layers (Table 5.4). In the general chert category, local Swan River chert (SRC) dominates in most layers. Quartzite, crystalline quartz, chalcedony, silicified wood and silicified peat (see Johnson 1986: 71-80) are moderately common materials. However, the combined miscellaneous material category is the second largest grouping in some of the lower layers. The miscellaneous category includes silt/mudstone, pebble siltstone, fused sandstone, feldspathic siltstone (Johnson 1986: 92-95), Tongue River silicified sediment (Keyser and Fagan 1987) and diatomite (Finnigan *et al.* 1985: 9-4). Local siltstone materials dominated this miscellaneous category. One of these local siltstones, Gronlid siltstone, has been called "altered felsic lava" and "River House chert" (see Johnson 1986: 84-88). It is black with some white speckled patination. The only Tongue River silicified sediment material recovered was in layer 12, spread through units 122N 110E,

Table 5.4 Percentage of Chipped Lithic Material per Layer and Total Number of Chipped Lithics per Layer

Lay	Chrt/SRC (%)	Qrtzt (%)	Qrtz (%)	Chal/SPT (%)	SWD (%)	SiS (%)	SS (%)	GSiS (%)	Misc (%)	Total #
8	60/48	24	4	4/0	8	0	0	0	0	45
9	88/35	12	0	0/0	0	0	0	0	0	35
10	82/61	0	0	1/0	0	2	0	0	12	73
11	70/62	2	1.4	5/3	0.6	0	0	1	20	403
12	70/64	5	5	2/0	5	8	1	0	4	1683
13	80.1/71	4	2	8/6	0.3	0	0.6	0.6	4.4	1073
14	63/25	6	13	0/0	6	0	0	0	12	28
15	100/100	0	0	0/0	0	0	0	0	0	8

Abbreviations: Lay=Layer; Chrt=Chert; SRC=Swan River chert; Qrtzt=Quartzite; Qrtz=Crystalline Quartz; Chal=Chalcedony; SPT=Silicified Peat; SWD=Silicified Wood; SiS=Siltstone; SS=Sandstone; GSiS=Gronlid Siltstone; Misc=Miscellaneous

121N 110E and 120N 110E. It included nine pieces all within the 5.7 mm to 12.5 mm size range and weighing 3.4 gm in total. These few remains of an imported material seem to reflect debris from the rejuvenation of a tool.

The lithic debitage for each layer is broken down into flakes and shatter of the five different size categories: < 5.7 mm, 5.7 mm to 12.5 mm, 12.5 mm to 25.0 mm, 25.0 mm to 50.0 mm and > 50 mm. These size categories can be used in calculating indices of lithic production for each layer. Flakes of the smallest size, <5.7 mm, may be roughly equated with retouch or sharpening flakes and perhaps some "spontaneous" retouch microflakes. The second size category may equate with secondary thinning flakes of finer quality lithics. Other larger size categories, 12.5 mm to 25 mm and 25 mm to 50 mm, may contain such secondary thinning flakes of blanks and secondary cores, as well as flakes to use as tools. The largest category, >50 mm, would likely represent the primary and secondary flakes from larger cores, perhaps in primary core biface thinning. Such larger flakes may also have been intended for expedient use.

Shatter in the smallest size category, <5.7 mm, would likely approximate the debitage in preparation of edges for retouch or thinning flakes. Larger sized shatter may represent the less successful production of flakes for tools, decortication of cores and core preparation, as well as breakage of poor raw lithic materials.

A debitage index is calculated for each layer, following a method similar to that of Ericson's (1984: 4). It is modified by having the smallest size category of flakes approximate the retouch and resharpening flakes. Thus, the percent frequency debitage index for each layer is calculated as follows:

$$\text{Debitage Index} = \frac{\text{All debitage - flakes less than 5.7 mm}}{\text{Total chipped lithic tools + All debitage}} \times 100$$

It must be noted that all the microdebitage from the fine-screen samples is not included in these calculations. The excavation procedure by trowel often revealed the smaller flake sizes (those less than 5.7 mm) and they were mapped and collected from an *in situ* context. This approach, therefore, is biased in that much of the microdebitage is not included. However, the available data still provide some comparison of the different layers, and will likely be skewed in the same direction assuming that the microflakes are recognized equally as well in each excavated layer.

The debitage index for each layer is presented in Table 5.5. Most layers have debitage indices between 88% and 100%. Only layers 13(1) and 13(3) have indices lower, 78% and 56% respectively. This reflects the presence of the small size category "retouch" flakes that decreases the numerator. This index, therefore, suggests that relatively more sharpening and retouch activity was occurring in these layers. Layers 12 and 13(2) also have many small sized flakes, but these are offset by the greater amount of debitage and tools overall.

Table 5.5 Chipped Lithic Indices for the Redtail Site Layers 8 to 15

L.	Debitage Index (%)	Cortex Index (%)	Core Index* (%)	Biface Index (%)	Total Debitage
8(1)	100	8	0 (0/0)	42	14
8(2)	100	9	100 (1/1)	18	25
9	100	20	50 (1/2)	22	35
10	94	15	0 (0/1)	38	73
11	98	13	100 (1/1)	16	403
12	96	13	50 (10/20)	18	1683
13(1)	78	41	36 (4/11)	20	535
13(2)	88	17	33 (2/6)	20	427
13(3)	56	56	0 (0/3)	44	62
13(4)	90	50	0 (0/3)	14	49
14	100	50	0 (0/2)	50	28
15	100	0	0 (0/0)	0	8

* the percentage core index is followed by the number of *reduced* cores / total cores in each of the layers / sublayers presented.

Therefore, retouching or sharpening is part of the activities apparent in these layers as well, but it is overwhelmed by greater general reduction activity.

The cortex index was calculated (modified from Ericson 1984: 4) in the following manner:

$$\text{Cortex Index} = \frac{\text{Debitage with cortex present}}{\text{Total Debitage} - < 5.6 \text{ mm size flakes}} \times 100$$

This is calculated for each layer and the results are presented in Table 5.5. Layers 13(1), 13(3), 13(4) and 14 have the highest relative amounts of cortex. Layers 9, 10, 11, 12 and 13(2) have moderate to low amounts of cortex on lithic materials, and layers 8(1) and 8(2) have little cortex. Both layers 11 and 12 have high amounts of debitage overall, and the relatively low cortex indexes may indicate import of more secondary cores and blanks than primary cores. Layer 15 had no cortex on any of its lithics.

Another calculation is the core index (modified from Ericson 1984:4). It was determined in the following way:

$$\text{Core Index} = \frac{\text{Reduced cores + those with >1 striking platform}}{\text{Total Cores}} \times 100$$

Results are presented in Table 5.5. This index is problematic due to the small sample size. However, it does help to compare the number of "more" reduced cores to those that are minimally reduced. Layers 12 and 13(1) are the only ones that contain "reduced" cores. The addition of cores with more than one striking platform can may provide a rough indicator of cores reduced further than the initial primary core stages. Of course, cores with only one striking platform may be poor or flawed materials, but on the other hand they may reflect a short immediate use. Cores that are greatly reduced may reflect a continued use. Also, continued use of cores could indicate that the site was inhabited over a longer period or during the season(s) when it is difficult to obtain fresh nodules (e.g. winter).

Layers 12, 13(1) and 13(2) have the overall greatest number of cores. Layer 12 has the highest number of reduced cores (10) which is 50% of the total cores in this layer. The abundance and the reuse of cores may suggest a longer or more frequent habitation, a more intense habitation, or a winter seasonality. Other layer 12 information may support or contradict these postulates. Layer 13(1) and 13(2) cores have similar indices of core reduction (36% and 33%, respectively). These indicate that lithic reduction was a dominant activity in these assemblages but less so than for layer 12. Layers 8, 9 and 11 have only one or two cores but contain at least one reduced core. These may suggest a more limited task specific activity (e.g. biface or tool production). Layers 10, 13(3), 13(4) and 14 have one to three cores in each layer and none are reduced. This suggests a shorter duration of occupation (e.g. production of some flakes for immediate use).

Comparison of the core index to the cortex index, reveals that layers 13(1), 13(3), 13(4) and 14 exhibit reduction of primary cores (e.g. decortication of cobbles). The other assemblages with cores but less cortex on specimens, suggest that cores were initially reduced or "tested for quality" away from the site. Then the decorticated or partially decorticated cores were brought to the site for use. The presence of some cortex in other layers may reflect the cortex from partially reduced cores or the use of the odd primary core.

A final index calculated in Table 5.5 is the biface index (modified from Ericson 1984: 4). This was calculated by:

$$\text{Biface Index} = \frac{\text{5.7 mm to 12.5 mm flakes}}{\text{Total Debitage}} \times 100$$

The 5.7 mm to 12.5 mm flake debitage are considered to approximate the size and category of finer bifacial thinning flakes. Of course, there will be some general thinning and a few expedient use flakes represented as well. Layers 8(1), 10, 13(3) and 14 have the highest percentages in this Biface Index, ranging between 38% to 50%. Most other layers are clustered between 14% and 22%. It may be noted that the deepest layers 14(2), 14(3) and 15 do not have flakes of this size category at all.

Comparison of a flakes to shatter ratio for each layer may reflect some important chipped lithic assemblage characteristics. Greater relative amounts of shatter may reflect poorer quality or coarser lithic materials and may also indicate that the hard hammer percussion technique dominated the core reduction activity(ies). On the other hand, greater relative amounts of flakes may reflect the production of flakes for use as expedient tools or the increased degree of use of the soft hammer percussion technique. Three general groupings are noted. Those layers with considerably more flakes than shatter include 8 (ratio of 1.5:1), 13(4) (ratio of 1.9:1) and 14 (ratio of 1.9:1). This may indicate better quality lithics, production of flakes for expedient use and/or the use of the soft hammer percussion technique. At the other extreme, layers 9, 11 and 12 contain 2.5 to 3.2 times the shatter compared to flakes. This may reflect poorer materials, a greater amount of lithic reduction activity and/or dominant use of the hard hammer percussion technique. The remaining layers 10, 13(1), 13(2), 13(3) and 15 have nearly equal flake to shatter ratios. Thus, these layers are intermediate in reflecting the explanations posed above to account for these two different types of debitage.

5.5) Cores

There are 49 cores identified from layers 8 to 15. Some of the metric and non-metric attributes are presented in Table 5.6. Layers 8 through 11, inclusive, have few cores. Layer 8(2) has only one small Swan River Chert (SRC) core that was bipolar reduced. Layer 9 has two cores, one larger quartzite core bifacially

Table 5.6 Redtail Site Core Metrics and Nonmetrics

Cat. #	Unit	Layer	Material	Weight (gms)	Length (mm)	Width (mm)	Thickness (mm)	# Striking Platforms	Comments
3648	121N 109E	8(2)	SRC	6.3	38.0	18.1	9.6	2	Bipolar
2977	123N 113E	9	Quartzite	265.1	83.2	79.2	36.3	3	Bifacial
4169	121N 108E	9	Chert	13.4	38.7	21.2	19.3	1	Amorphous
4609	124N 106E	10	Peb Chert	4.2	28.5	15.3	10.3	1	Pebble Frag
1171	124N 112E	11	SRC	290.4	96.2	71.1	41.0	3	Amorphous
508	122N 114E	12(1)	Quartzite	738.3	128.9	111.5	39.4	1	Cobble/Chopper
469	122N 114E	12	Quartzite	140.9	65.2	52.5	36.6	2	Cobble
1175	124N 112E	12	Quartzite	699.2	117.9	110.2	42.4	1	Split Cobble
1387	122N 112E	12	SRC	28.1	45.7	38.8	16.3	1	Bifacial/Reduc
1390	122N 112E	12	Sil Wood	28.3	40.4	21.0	19.0	1	Unifacial
1397	122N 112E	12	Quartz	37.6	41.9	31.3	25.6	2	Cobble
1535	121N 112E	12	Quartz	28.5	52.6	22.3	20.8	1	Cobble Frag
1920	122N 111E	12	SRC	36.7	53.9	35.8	17.3	2	Bifacial/Reduc
2147	121N 111E	12	Sil Peat/Ht	10.1	36.6	23.4	12.6	2	Unifacial
2169	121N 111E	12	Sil Wood	23.7	79.7	24.4	10.9	2	Amorphous
2171	121N 111E	12	Peb SiltSt	3.5	24.1	16.9	8.0	1	Bipolar
2505	122N 110E	12	Quartz	28.5	41.4	29.5	21.5	1	Amorphous
2826	121N 110E	12	Sil Wood	14.8	58.1	29.7	6.5	1	Bipolar
2852	121N 110E	12	Quartzite	43.0	45.0	42.3	20.2	2	Cobble Frag
3403	123N 109E	12	SRC	411.7	100.0	93.1	47.0	2	Bifacial
3603	122N 109E	12	Chalcedony	38.4	37.4	34.2	27.3	1	Unifacial
3702	121N 109E	12	Quartz	50.2	50.9	37.8	27.3	1	Cobble Frag
3709	121N 109E	12	SRC	14.0	38.4	26.8	16.5	2	Bifacial/Reduc
3977	123N 108E	12	SRC	24.2	36.5	33.3	19.3	3	Bifacial
4207	121N 108E	12	Chert	9.4	28.7	24.0	14.8	2	Amorphous
487	122N 114E	13(1)	SRC	6.5	33.6	20.0	10.5	2	Bipolar
1189	124N 112E	13(1)	SRC	18.9	44.1	34.6	13.2	1	Bifacial/Reduc
1633	124N 111E	13(1)	Quartzite	227.5	104.8	70.2	29.1	1	Unifacial
2588	122N 110E	13(1)	Peb SiltSt	0.9	20.0	15.9	4.8	1	Bipolar
2590	122N 110E	13(1)	Quartz	43.9	51.6	43.9	17.7	1	Unifacial
2963	121N 110E	13(1)	Peb SiltSt	2.0	19.5	10.0	7.3	1	Split Pebble
3127	120N 110E	13(1)	Gron SiltSt	11.8	33.9	22.1	12.4	1	Bipolar
4238	121N 108E	13(1)	SiltSt	44.6	49.0	49.0	26.9	2	Bifacial
4402	123N 107E	13(1)	Chert	13.5	34.9	24.4	18.0	2	Amorphous
4824	120N 106E	13(1)	Quartzite	215.4	87.3	68.7	48.3	1	Unifacial
4956	121N 110E	13(1)	Quartz	83.9	64.2	43.0	28.7	2	Cobble
382/394	123N 114E	13(2)	SRC	13.4	46.5	41.6	10.6	1	Bifacial
384	123N 114E	13(2)	Sil Peat	29.1	65.8	31.8	17.0	1	Bifacial
530	122N 114E	13(2)	Sil Peat	126.9	92.3	64.4	20.6	1	Bifacial
531	122N 114E	13(2)	Sil Peat	66.2	75.5	55.4	22.1	1	Bifacial/Heated
1440	122N 112E	13(2)	Chert	61.7	64.9	48.6	19.3	2	Bifacial
3274	124N 109E	13(2)	Chert	7.8	31.6	20.6	11.4	2	Bipolar
1112	121N 113E	13(3)	Feld SiltSt	89.0	67.5	55.2	23.2	1	Cobble Frag
4153	122N 108E	13(3)	Peb Chert	1.4	17.4	17.3	4.3	1	Bipolar Frag
4759	122N 106E	13(3)	Peb Chert	8.4	26.5	20.9	16.0	1	Pebble Frag
1680	124N 111E	13(4)	SRC	550.7	115.3	83.6	47.4	1	Unifacial
2211	121N 111E	13(4)	Quartz	9.5	29.5	20.1	15.4	1	Unifacial
2659	122N 110E	13(4)	SRC	288.5	81.9	78.2	48.4	1	Cobble
2208	121N 111E	14(1)	Peb SiltSt	13.6	27.7	25.9	14.7	1	Bipolar
2213	121N 111E	14	Sil Wood/Ht	6.4	28.9	14.9	12.5	1	Fragment

reduced from three striking platforms and a small SRC core. Layer 10 has one chert split pebble fragment. Layer 11 has one large SRC core with three striking platforms.

Layer 12 has 20 cores, more than half of the total cores from all these layers. Five of these cores are SRC, and another is a general chert. The remaining cores consist of four quartzite, four quartz, four silicified peat/wood, one pebble siltstone and one chalcedony. Seven of these cores have remnants of cortex. Others are further reduced, and include five bifacial and three unifacial types. Three others are amorphous cores, while the last is a bipolar reduced piece of silicified wood.

Layer 13(1) has 11 cores, about 1/4 of the total cores for all the layers. Two of the three chert cores are SRC. Coarser material cores include two quartzite and two of crystalline quartz. Four siltstone cores include, one Gronlid siltstone and two pebble siltstone varieties. All together, four bipolar, three unifacial, two bifacial, one cobble, and one amorphous type are identified.

Six cores are found in layer 13(2), including three silicified peat and three chert (one SRC) cores. Five of these are bifacially reduced while one is bipolar. Layer 13(3) has three cores. Two are bipolar-reduced chert pebbles and one is a larger cobble fragment of feldspathic siltstone. Layer 13(4) has three cores. These include two large unifacial SRC cobble cores and a small unifacial quartz core.

Layer 14(1) has two cores. One is a bipolar reduced pebble siltstone specimen, and the other is a heat-treated core fragment of silicified wood. Layer 15 has no cores.

5.6) Chipped Stone Tools

5.6.1) Projectile Points

There are only 11 artifacts that have attributes resembling projectile points. They are pointed hafted bifaces having sizes or weights that could have been used with an atlatl dart or a spear (see Browne 1940; Christenson 1986; Hill 1948). This designation does not rule out alternate uses. Other possible uses are suggested, based on reworking or use-wear on these tools. Points are present only in layers 11, 12 and 13 (Table 5.7).

There is one point in layer 11, #4952 (Figure 5.2). It is a body portion that includes the shoulders and part of the haft area, but the base and very tip have been snapped off. It is made from a local material identified as Gronlid siltstone. The ventral surface is completely retouched by shallow secondary flaking which has resulted in a nearly flat surface. The dorsal surface is more completely flaked as well, but the secondary flaking, with several flakes ending in step-terminations, has not successfully thinned the central portion of the point. This has produced a more pronounced thickening in the center of the point on the dorsal surface. Both edges are very sharp and have been retouched to produce a somewhat sinuous edge, particularly on the left edge. The shape shows indicates rounded shoulders which converge toward the neck at an obtuse angle (134° on the left and 118° on the right shoulder). This suggests a Hanna point type.

Six potential projectile points were found in layer 12. Three of these are complete, two are base fragments and one is a neck fragment. Table 5.7 includes the metric attributes, provenience and some nonmetric attributes of these points.

The first complete point to be described, is #2716 (Figure 5.2). It is made of a light gray somewhat translucent chert with white fossiliferous inclusions. The presence of at least four quartz-filled voids, or "drusy vugs" (Johnson 1986: 55), indicates a macroscopic identification as Swan River chert (Johnson 1986: 67-

Table 5.7 Redtail Site (FbNp-10) Projectile Point Attributes

Cat #	Unit Coord.	Layer	Quad	Material	Type or Description	Color	Portion	Max Lgth	Max Wdth	Max Thk	Neck Wdth	Base Wdth	WT. (gms)
4952	124N 108E	11	NW	Grnld SltSt	Hanna	Black	Base Missing	NA	20.0	6.2	14.1	NA	3.0
2716	121N 111E	12	NW	Chert	Hanna	Gray/Wt	Complete	31.0	17.1	5.9	11.9	13.5	3.0
2718	121N 111E	12	NW	Siltstone	Hanna	Wt/Gray	Complete	30.0	17.9	5.0	10.9	12.3	1.9
2788	121N 110E	12	SW	S.R. Chert	S-N/Stem	Pi/Br/Wt	Complete	21.9	16.6	6.4	14.0	15.3	3.0
2889	121N 110E	12	NW	Siltstone	Side-Notch	Gray	Base Frg	NA	15.0	4.6	11.7	15.0	0.5
4534	120N 107E	12	NW	SRC	Side-Notch	Pink/Wht	Neck Frg	NA	NA	5.6	13.1	NA	0.9
4958	124N 108E	12	NE	S.R. Chert	Duncan?	White	Base Frg	NA	NA	5.9	16.4	17.9	1.3
276	124N 114E	13 (2)	SE	S. R. Chert	Duncan?	Brown	Base Frg	NA	16.3	5.6	16.3	15.9	1.5
353	123N 114E	13(2)	NE	S.R. Chert	McKean Lanc?	Or/Pi/Wt	Base Frg	NA	16.3	5.3	NA	15.1	1.0
1964	122N 111E	13(4)	SE	S.R. Chert	McKean Lanc	Brown	Complete	32.2	20.6	4.9	NA	20.6	3.0
2717	121N 111E	13(4)	SW	S.R. Chert	Mckean Lanc	White	Tip Missing	NA	20.0	5.0	NA	18.7	2.8

Cat #	Dis Max Wd Frm Bs	Bod Lth Left	Bod Lth Right	N/S Ht Left	N/S Ht Right	N/S Dpth Left	N/S Dpth Right	Shld Wdth	Bas con Depth	Bas Ntch wd at bas	Bas Ntch wd in	Edg< Left	Edg< Right
4952	At Base	21.5	24.5	NA	NA	NA	NA	20.0	Straight	Straight	Straight	54	51
2716	11.3	21.2	21.3	11.3	9.8	2.0	1.6	17.1	0.0	0.0	0.0	58	49
2718	12.0	20.1	21.0	10.2	8.1	2.2	1.8	30.0	1.5	9.0	5.0	48	57
2788	10.8	19.3	19.6	8.2	7.2	1.1	1.4	16.6	1.2	10.6	NA	60	58
2889	At Base	NA	NA	NA	NA	NA	NA	NA	Straight	Straight	Straight	NA	NA
4534	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4958	NA	NA	NA	NA	NA	NA	NA	NA	2.9	8.6	5.5	NA	NA
276	Near Base	NA	NA	NA	NA	NA	NA	NA	2.0	7.4	5.2	NA	53
353	8.0	NA	NA	NA	NA	NA	NA	16.7	1.5	8.4	5.1	62	58
1964	1.0	33.3	32.1	NA	NA	NA	NA	20.2	5.7	11.4	5.3	45	32
2717	7.4	NA	NA	NA	NA	NA	NA	20.0	4.2	12.4	7.1	51	43

All measurements in mm, except edge angles (<) in degrees and weight in grams.

Note: Lgth=length; Wdth/Wd=width; Thk=thickness; Dis=distance; Bs=base; N=notch; S=stem; Ht=height; con=concavity.

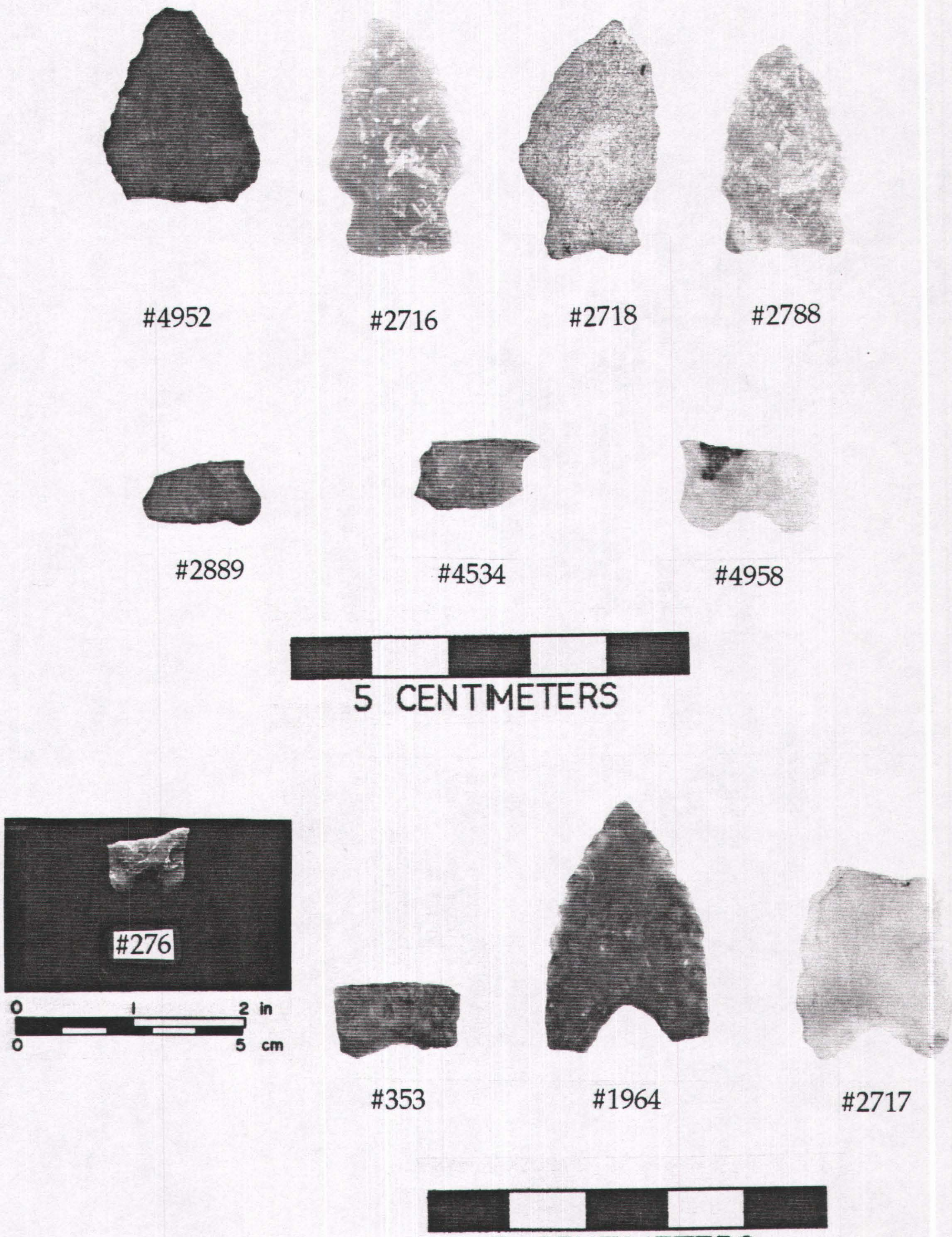


Figure 5.2 Projectile Points: #4952, layer 11; #2716, #2718, #2788, #2889, #4534 & #4958, layer 12; #276 & #353, layer 13(2); #1964 & #2717, layer 13(4)

71). A bulb of percussion is still apparent toward the base and neck area which is the thickest part of the point. Only some marginal retouch along the blade edges and shaping along the base and notches has modified the original ventral surface. Towards the tip the surface is flat, except for about 2 mm of marginal retouch on either side. The dorsal surface has three shallow step-termination secondary flakes, while the remainder are feather terminations. There is a moderate thickening toward the central axis of the point but it is not considerable. Both edges are somewhat rounded or smoothed, particularly on the right. The overall shape of the edges incurves from the shoulders to the mid-point of the body suggesting reworking of the blade. The right side curves convexly to the tip which is 2 to 3 mm left of the central axis of the point. In contrast, the left side is relatively straight, until it angles abruptly in towards the other edge near the tip. These modifications of the blade portion suggest a use other than as a projectile point. The use-wear present may be from cutting materials such as meat, hide or softer woods. This tool, however, may have functioned as a projectile as well. The haft area fits within the range of variation defined for Hanna points. Shoulders, even though they are reduced in angle and are sharper due to blade retouching, are obtuse at 132° on the left and 133° on the right side. The broad notches or expanding stem intersects with a straight base. This basal configuration is not common for the Hanna type but is noted in some variants (see Quigg 1986: 122 and Figure 6.6 Nos. 6, 7, 9).

The second complete point, #2718, (Figure 5.2) is in layer 12. It is made of light gray diatomaceous earth (after Quigg 1986: 121-123) or diatomite (Finnigan *et al.* 1985: 9-4). A thickening toward the tip of the point is a remnant bulb of percussion of the original flake. Secondary flaking on the ventral surface is focused on thinning the bulb from the tip end in addition to a few larger thinning flakes which reach over halfway across the point's body. The dorsal surface is dominated by secondary retouch as well, shaping the margins of the blade and developing a sharp tip. Some crushing is evident along the right edge and it is sinuous dorso-ventrally. This may indicate that this edge was in the process of being reworked, with the crushing of the edge to prepare a more solid striking platform. Alternatively, this edge may have been used in cutting or incising a harder material such as wood or bone, but I prefer the previous explanation. The left edge is worn smooth or rounded on the ridges and most lateral jutting portions of the blade. Also, along the edge are about seven small (<1 to 1.5 mm) step-termination scars at angles between 30° to 70° from a line tangent to the edge of the blade. These terminations are disassociated from the tip. Such scars usually indicate use on a harder material, but there are only a few of them. There is also pronounced smoothing of the edges especially at the tip of the point. This wear suggests boring or punching, and perhaps the edge functioned in slitting holes in softer materials, such as leather or hides. Something like a tough or gritty hide may have dislodged the few small use-wear chips from the edge. These different kinds of wear may indicate at least two different types of use for this tool. The tip is offset about 3 mm right of the longitudinal axis due to rejuvenation flaking to shape the tip. Thus, this tool has likely been reworked from a former symmetrical point. However, even if this tool was designed for use in cutting and boring/punching, the hafted base does have a Hanna morphology. The left shoulder is a rounded 139° and the right shoulder is a sharp 145°. It has an expanding stem, and a concave base with rounded basal edges at acute (R=56°, L=61°) angles. The haft area is thinned by flaking and slightly crushed or dulled in the narrowest part of the neck.

The third complete point from layer 12 is #2788 (Figure 5.2). It is made from a fine to medium quality pink, tawny and white mottled piece of Swan River chert. It is completely covered by secondary flake scars over both surfaces.

The dorsal surface thickens considerably toward the longitudinal axis of the point. This may be due to seven step-terminated thinning flakes from the left side which extend only 2 to 4 mm in from the edge. It is thickest in the neck area but has a fair thickness throughout its length to give the tip a blunt appearance. However, both edges are relatively sharp, as would be expected on a functioning projectile point. The tip is aligned with the longitudinal axis and the point is symmetrical overall, except for some variation in the stem/notch length on either side. On the right side there is a very shallow, narrow notch with a sharp obtuse shoulder and the bottom edge of the notch is poorly defined. The left side is more stem-like, with a shallow, wide notch that intersects with an obtuse sharp shoulder. Edges are rounded and smoothed in both notches. Both basal edges are rounded and the left edge is at a right angle to a straight/slightly concave base, while the right side has a more acute 80° angle. The style of this point is indeterminate, as the left stem-like side gives it a vague Duncan-like appearance, but the right side is more notched. If more of the body were present, as was likely the case prior to its present rejuvenated condition, it may be identified as a Duncan or Hanna type. Regardless of what point type it resembles, it could be a functional projectile point, although, it is rather stubby. Perhaps the maker, on working this point down to a thickened stub, was not satisfied with the result and discarded it. This might also explain the different shoulder/stem morphology and its presence in a midden feature.

There are three other point fragments from layer 12. Catalogue #2889 (Figure 5.2) is a base with only part of the neck still present. It is made of a dark gray siltstone or mudstone. It has rounded, smoothed side-notches which may be part of an expanding stem. The base is straight and the basal edges are rounded, smoothed and acute (L=55° and R=57°). This base can not be typed.

A small hafted biface tool neck fragment, #4534, is also present in layer 12. It was made of pinkish white Swan River chert. It appears to have been part of a haft made by deep, wide notches or an expanding stem. There is little smoothing of the notches, though they are slightly crushed. A hinge fracture across one of the surfaces emanates from the snap break of this tool. This item has a neck width suggestive of a projectile point but is of indeterminate type.

The last point basal fragment from layer 12, #4958, (Figure 5.2) is made from a fine-grained, white Swan River chert. It has a rounded, smoothed haft area and seems to have an expanding stem. The basal edges are rounded and slightly obtuse. There is a distinctive basal notch about 8.6 mm across at the base and 2.9 mm deep. With the shoulders missing it is difficult to say, but this fits criteria for a slightly expanding stemmed Duncan, or perhaps a Hanna, style point.

There were four projectile points from layer 13. Two basal fragments were found in layer 13(2), within a meter of each other. The first of these, #276, is made of brown SRC. Basal edges are rounded in the haft area. It is difficult to determine a type from this fragment but it seems to be expanding to a shoulder on one side. This may be either a Duncan or a slightly constricted haft area of a McKean Lanceolate point type.

The other point, #353, (Figure 5.2) is made of a mottled pinkish-orange and white Swan River chert. The edges of the blade are rounded and smoothed. However, the concave base remains sharp from the thinning flakes, except for one small portion of basal edge that is broken off. The sides appear to have been expanding slightly away from the base. This seems to be a McKean Lanceolate type, but this identification is tentative. The edges are rounded somewhat along the haft area.

The other two points from layer 13(4) are more complete. First of these, #1964 (Figure 5.2) is made from brown mottled Swan River chert. It is complete except for the extreme corners of the basal edges. Secondary flaking has completely removed all traces of primary flake scars, and has thinned the point well. Some nibbling is evident on both working edges of the blade. This may be preparation for retouching of the blade or may result from some use. The basal edges have some limited crushing and rounding in the haft area. There is a deep (5.7 mm) and wide (at least 11.4 mm) basal notch. This notch is rounded and smoothed at the apex. This item would still function perfectly well as a McKean Lanceolate projectile point. However, the blade of this point has been reduced from a larger point or biface. Perhaps it broke at the haft when it was being rejuvenated and was discarded, or broke off its shaft inside an animal that was at the site.

The last projectile point to be described is also a McKean Lanceolate type from layer 13(4), catalogue #2717 (Figure 5.2). The tip is broken off. It is made from white SRC. Secondary thinning flakes are removed from both surfaces, and some end in step-terminations. Slight crushing is evident at the basal edges. A v-shaped basal notch is deep (4.2 mm) and wide (12.4 mm), and is produced by thinning flakes. The tip is snapped off at a vug or flaw in the material.

5.6.2) Large Hafted and/or Pointed Bifaces

There are five large hafted and / or pointed bifaces. These are probably too large to have been used as projectile points. These may have, however, been used on larger thrusting spears as Johnson (1975: 10) proposed for similar items from the Sullivan site (EjNr-1). Two of these tools are in layer 12 and three in layer 13. Table 5.8 presents metric data for these tools.

Two specimens from layer 12 include a tip, #2546, and a basal / neck fragment, #2795 (Figure 5.3). The pointed fragment is thickest (8.4 mm) about 11

Table 5.8 Redtail Site Hafted and/or Pointed Large Biface Metrics

Cat #	Unit/Quad	Layer	Max Lgth	Max Wth	Dis Max Wd Frm Bs	Max Thk	Bod Lth Left	Bod Lth Right	N/S Ht Left	N/S Ht Right
2546	122N 110E/SE	12	NA	NA	NA	8.4	NA	NA	NA	NA
2795	121N 110E/SE	12	NA	29.2	5.3	10.4	NA	NA	NA	NA
2715	122N 110E/SW	13(1)	81.5	31.9	25.0	10.1	59.7	62.1	23.0	22.9
3764	121N 109E/SE	13(2)	NA	NA	NA	8.2	NA	NA	NA	NA
1577	121N 112E /SE	13(3)	NA	NA	NA	6.7	NA	NA	NA	NA

Cat #	N/S Dpth Left	N/S Dpth Right	Shld Wth	Base Wdth	Neck Wdth	Bas Con Depth	Bas Ntch Wd at bas	Bas Ntch wd in	Edg < Left	Edg < Right	Wt (gm)
2546	NA	NA	NA	NA	NA	NA	NA	NA	57	64	3.8
2795	NA	NA	NA	29.2	23.5	4.0	13.7	8.0	66	73	8.9
2715	22.9	2.7	3.2	26.9	23.3	2.0	21.8	15.4	50-54	48-57	28.7
3764	NA	NA	NA	NA	NA	NA	NA	NA	70	49	2
1577	NA	NA	NA	NA	NA	NA	NA	NA	53	55	2.6

Measurements are in mm, except edge angles (<) in degrees and weight in grams.

Note: Lgth=length; Wth/Wd=width; Thk=thickness; Dis=distance; Bs=base; N/Ntch=notch; S=stem; Ht=height; con=concavity; Edg=edge; <=angle.

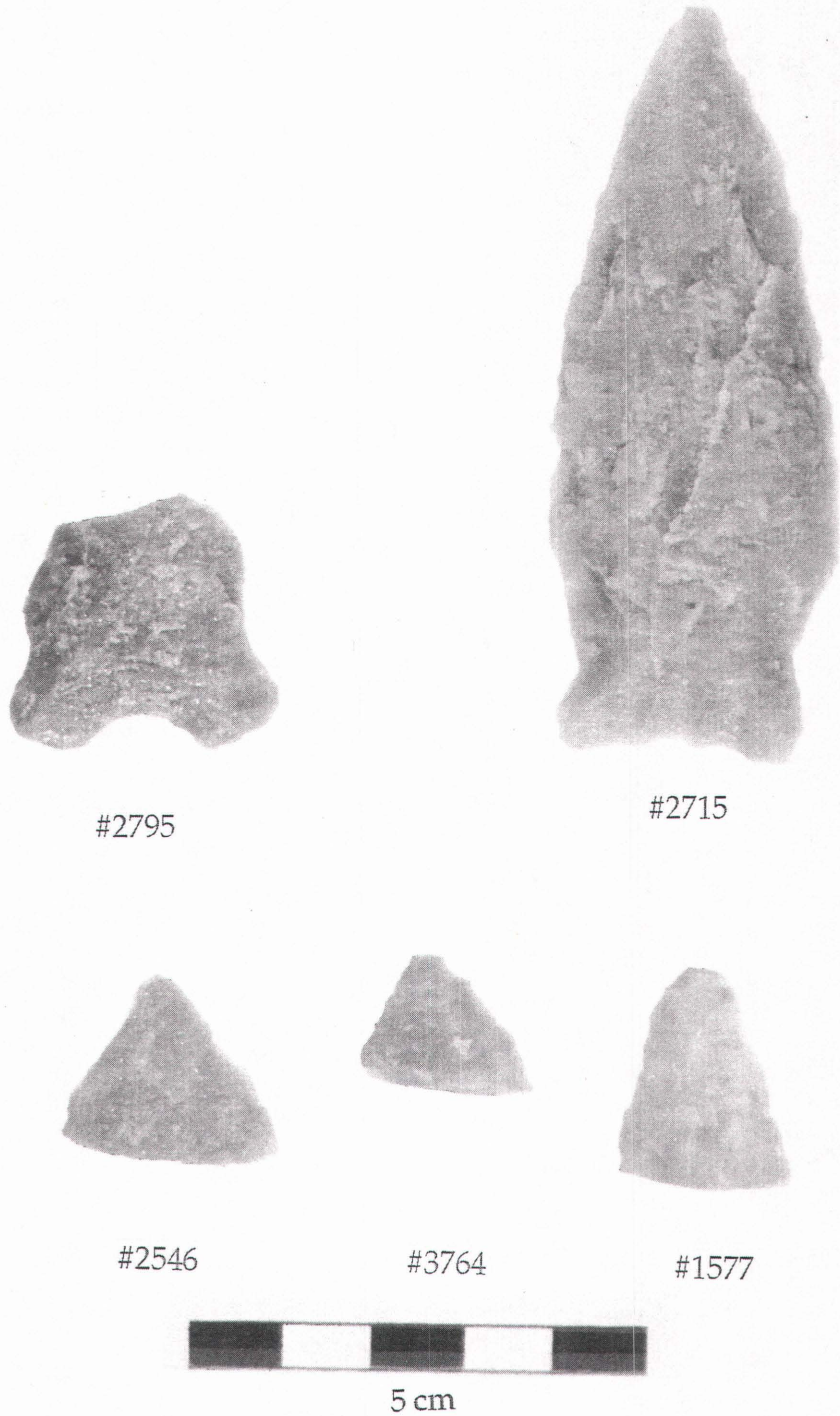


Figure 5.3 Large hafted and/or pointed bifaces

mm in from the tip, and the two edges meet at a 73° angle. It is made of a reddish-brown quartzite with sharp, unworn edges. Secondary retouch is along the margins but some larger sharpening flakes with feather terminations are still evident (e.g. 8.5 to 10.5 mm across and extending about 7 to 9 mm in from the edge). This may suggest a soft percussion method of flaking (see Reeves 1970: i-ii).

Catalogue #2795 (Figure 5.3) is a base/neck fragment of a larger thick (10.4 mm) hafted biface. It is made of a brown quartzite. It has wide rounded or smoothed side-notches and a wide (13.7 mm), chipped basal notch. The shoulders and body are snapped off and thus suggest a basal shape that is Oxbow-like. The similarity to Oxbow is due to the "eared" appearance of the basal edges, but the haft notches are broad and may have been more stem-like on the complete specimen. It is thick and broad which suggests that it was not likely to have functioned as a projectile. Also, the worn side-notches may hint at haft-wear , possibly as a hafted knife or the notches may have been deliberately ground and dulled. The snapped and fragmentary nature of the piece may also support a more vigorous use as a thrusting spear, as Johnson (1975: 10) suggested for similar items.

In layer 13 three pointed, large bifaces are fit into this category. One of these, #2715, (Figure 5.3) is a complete hafted, pointed biface, while the other two are tip fragments. The complete specimen from layer 13(1) was made of a light gray quartzite. Its maximum length is 81.5 mm, about 40% longer than the longest point at the Redtail site. It bears complete secondary flaking over both surfaces, with marginal retouch. The edges are sharp except for some sporadic crushing. There are a few associated step-terminated fractures. The body is twisted clockwise. There is a flaw in the material on one side and some step-terminations on the other side cause the specimen to be relatively thick. A small hinge scar provides evidence that the extreme tip of this tool was removed. Proximally it has large, stem-like angled notches. The shoulders are abrupt but rounded with obtuse angles (L 152° and R 166°). Apices of each notch are offset, and both are worn or rounded. The basal edges are straight, rounded and form nearly a right angle with the flaked concave base. This tool appears to be Hanna-like in its morphology. Due to the asymmetric wear areas in the notches, this might be considered a hafted knife, although the blade itself is more or less symmetrical and may have functioned as a large thrusting spear point.

A large biface tip from layer 13(2), #3764, (Figure 5.3) is made of a red-and-white mottled Swan River chert. The two edges converge at about a 66° angle and even this small fragment is 8.2 mm thick near the tip. Though one edge is sharp, the other is crushed and subsequently rounded smooth in some areas. Crushing would indicate use on harder materials such as bone or antler, and perhaps the rounding may occur with continued use on these materials as well as on softer materials.

The other tip fragment, from a large biface in layer 13(3), #1577, (Figure 5.3) is snapped off. It has a hinge scar on one surface emanating from this snap. It is made of a mottled, tawny brown chert with a thin reddish brown cortex. This is likely Swan River chert though no obvious vugs are present. The pointed end of the tool ends with cortex on the tip. Cortex is also present on a portion of the hinge-scarred surface. The other surface has nearly complete secondary flaking except for a "bump" produced medially by step-terminated scars. A few small nibbling scars are present on the edges as well as some rounding of the protruding parts of the blade. This may indicate use of an item that might otherwise be considered broken during manufacture (because of the cortex on the tip).

Overall, these large pointed and/or hafted bifaces may have served as multipurpose knives and/or points for larger thrusting spears (after Johnson 1975:10). By the broken nature of four out of five of these tools, it would seem that they have been used in a "vigorous" way (e.g. thrusting spear). They may also have been broken during use as large knives, as butchering of larger animal carcasses is a vigorous task as well.

5.6.3) Other Bifaces

There are five other items that are considered bifaces, and are from layer 11 (Table 5.9), catalogue #4499 is identified as an ovate bifacial preform (Figure 5.4). It is made from a mottled red, orange and white Swan River chert. There is crushing along the edges that is probably preparation for larger thinning flake removal. Some of these larger flakes have been removed and many end in step-terminations (e.g. 5 dorsally and 8 ventrally). These unsuccessful attempts at thinning the preform probably made it less useful but it may have been saved for later use.

Another biface from layer 12 was found in two fragments that fit together, #4957 (Figure 5.4). The joined pieces produce a 60 mm length of a slightly convex bifacial working edge. The biface is 12.3 mm at the thickest point and seems to have been a relatively large, thin tool. It is made from a fine purple, pink and white mottled chert that is probably Swan River chert but there are no obvious vugs. The working edge angle ranges between 39° and 43° and the edge has some nibbling and is rounded, perhaps indicating use on softer materials.

Three bifacial fragments were recovered from layer 13. The piece from layer 13(1), #4955, is thin (3.8 mm), small and probably a triangular biface with the tip snapped off (Figure 5.4). It is made of Gronlid siltstone (see Johnson 1986: 84-88) and bears secondarily retouch over both surfaces. Both the edge angle

Table 5.9 Redtail Site Other Biface Metrics and Nonmetrics

Cat #	Unit	Layer	Material	Description	Max.Length (mm)	Max Width (mm)	Max Thick. (mm)	Edge Angle (Degrees)	Length Wkd Edge (mm)	Weight (gm)
4499	122N 108E	11	SRC	Ovte Pfrm	95.5	48.5	19.5	42-73	NA	86.2
4957	121N 105E	12	SRC	Lrg Bif	60	34.9	12.3	39-43	60	26
4955	121N 110E	13(1)	GrnldSltSt	Tri Shp	15+	15.4	3.8	32-34	15+14+13	1
1012	122N 113E	13(4)	Quartz	Edg Frg	20+	19.5+	8.5	50	15.5	3.3
2371	124N 110E	13(4)	SRC	Tri Bs Frg	NA	22.8	6.8	36-39	9+22+6	2

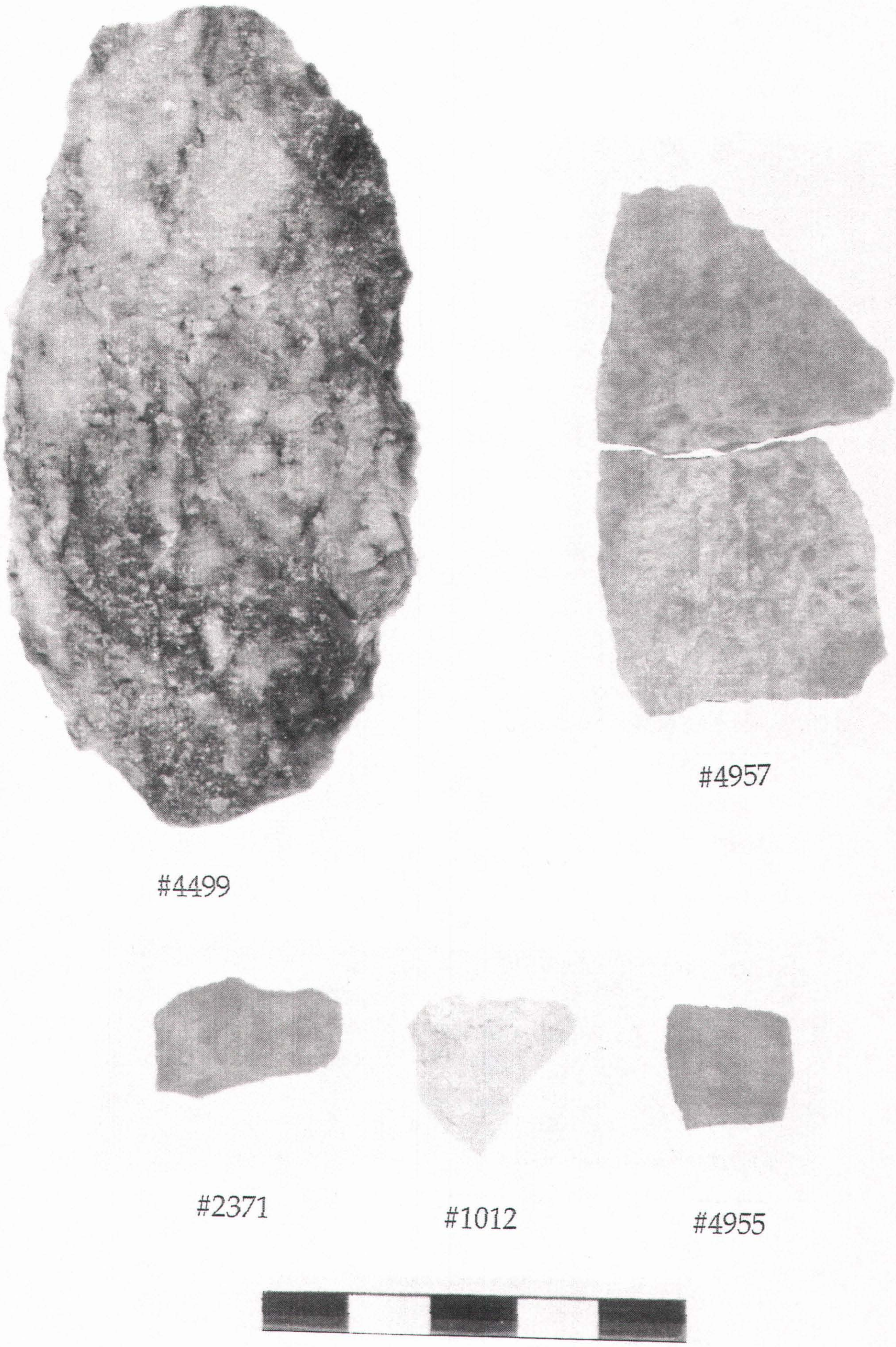


Figure 5.4 Other bifaces from the Redtail site

(38°) and base angle (42°) are shallow, retouched and have some small step-terminated use-wear or edge preparation scars.

The other two biface fragments are from layer 13(4). The first of these, #1012, is an edge fragment (Figure 5.4). Only one surface is secondarily flaked, while the other one has only marginal flaking. Its working edge is 15.6 mm long and has a 50° edge angle. No use-wear is evident on the fairly sharp sinuous edge. The tool was made of semi-translucent quartz.

The other biface piece, from layer 13(4), #2371, is made of pink and white mottled Swan River chert (Figure 5.4). It appears to be either a base and/or working edge of a thin, bifacial tool. Two roughly parallel lateral edges intersect with a convex edge at obtuse angles. The parallel sides are 22.5 mm apart which is also the width of the convex edge. Crushing is evident on the parallel sides to some degree, but crushing, nibbling and rounding are most apparent on the convex edge. This edge has an angle between 36° to 39°. A black residue is present on both surfaces and concentrated at this convex edge. Without residue analysis it cannot be determined. This residue may be pitch or blood glue used in hafting the tool, or it may be blood or plant residue from use. However, residue analysis has not been carried out to determine its nature or source.

5.6.4) Hafted Pointed Unifaces

There are two hafted, pointed unifacial tools and both are from layer 12 (see Table 5.10). They are complete and shaped like bifacial projectile points, thus, some have call these "flake points". However, they seem to be a more distinctive tool type (technologically and functionally). The first of these, #2036, is made of a black siltstone (Figure 5.5). A concentric line on the ventral surface indicates that the striking platform was located at the base or haft end of the tool. Only use-wear nibbling, smoothing and crushing have modified the edges of the ventral surface. However, the dorsal surface has primary flaking across it and

Table 5.10 Redtail Site Hafted and Pointed Uniface Metrics

Cat #	Unit/Quad	Layer	Max Lgth	Max Wth	Dis Max Wd Frm Bs	Max Thk	Bod Lth Left	Bod Lth Right	N/S Ht Left	N/S Ht Right	N/S Dpth Left	N/S Dpth Right
2036	121N 111E/SW	12	24.6	14.6	10.0	4.8	15.8	13.9	7.2	9.6	1.4	2.6
3710	121N 109E	12	17.5	11.9	7.4	2.9	11.7	8.3	5.6	5.9	1.8	1.1

Cat #	Shoulder Width	Base Wdth	Neck Wdth	Bas Con Depth	Bas Ntch Wd Out	Bas Ntch wd in	Edg < Left	Edg < Right	Wt (gm)
2036	14.6	10.0	8.3	Convex	Convex	Convex	47	31-47	0.8
3710	11.9	8.3	7.4	0.7	6.2	3.9	53	54	0.4

Measurements in mm, except edge angles (<) in degrees and weight in grams.

#2036 #3710

Figure 5.5 Small hafted and pointed unifaces

some marginal step-terminated secondary flaking. The thickest part of the tool is across the neck area.. Glossy polish is apparent on the dorsal scar ridges and along the blade edges. Some nibbling can also be seen on the edges. This indicates use of the blade edge on softer materials such as fresh hides, nonwoody plants or other materials of similar hardness. An expanding stem has two deep wide notches that are smoothed, rounded and have many striations oriented dorso-ventrally. These striae may have been produced by the technique for rounding out the notches prior to hafting in this softer siltstone material. The convex base has crushing, step and hinge-terminated scars ending abruptly in the thick neck area. Some glossy polishing is apparent on the edge of the base, perhaps indicating its use on softer materials as well. The base is similar to an endscraper and may have functioned as such.

Another smaller hafted, pointed uniface (complete) was also recovered from layer 12. Catalogue #3710 (Figure 5.5) is made of a gray siltstone. This "miniature" is 17.5 mm long. A curved force line indicates that the original striking platform is at the base end. Other than some thinning of the base, only use-wear nibbling has modified the ventral surface. The dorsal surface has marginal secondary flaking to shape the tool, and crushing on both blade edges from use or additional shaping modification. Notches are crushed and produce an expanding stem. The base is flaked and slightly concave. This produces a Hanna-like morphology, and is also quite similar to the other hafted, pointed uniface. This seems to be an expedient tool used very little. Therefore, it may have been a "toy" tool for children to use in a similar fashion as the other hafted pointed uniface, or as a crude point.

5.6.5) Other Unifaces

Seven tools are part of this conglomerate category (Table 5.11). This grouping includes items with substantial unifacially retouched and shaping, such

Table 5.11 Redtail Site Other Uniface Metrics and Nonmetrics

Cat. #	Unit	Layer	Weight (gm)	Material	Length (mm)	Width (mm)	Thickness (mm)
2499	122N 110E	10	0.6	Peb SltSt	12.1	10	3.9
4953	122N 110E	10	2.3	SRC	17.9	19.8	5
2978	122N 111E	11	3.3	SRC	34.7	15.6	5.6
1618	124N 111E	12	8.2	SRC	28.7	32.5	8.6
550	122N 114E	13(2)	2.7	SRC	26	21.4	6.7
757	124N 113E	13(2)	4.5	SRC	20.8	24.1	8
1965	123N 113E	13(2)	2	Chert	16.8	31.4	4.7

Cat. #	# Worked Edges	Edge Length (mm)	Type/ Descript.	Edge Shape	Edge Angle (Degrees)
2499	2	9.5 & 10.5	Uniface	straight	65 & 60-70
4953	3	6/5.5/5.5	Graver/+	notches & tips	73-76 in notch
2978	2	32.5&35.0	Graver/+	concv/convx	54-56/tip=28-30
1618	2	13 & 17	Uniface	strt & rnd cor	60-64
550	2	17.8 &18.4	Uniface	strt & ptd tip	58-61/tip=48-49
757	1	23.2	Endscraper	convex	68-72
1965	2	22.5	Uniface	straight	60-65

as endscrapers, sidescrapers and other notched tools. Two such tools are from layer 10. The first of these, #2499, is a small fragment of black pebble siltstone retouched on two sides. It is only 3.9 mm thick, has steep edge angles between 60° to 70°, and crushed working edges. This may be considered a small sidescraper fragment.

The second unifacial tool in layer 10 is #4953 (Figure 5.6). It has three notches and three pointed tips that are snapped off to varying degrees. The striking platform is still apparent on this tool, and it is only marginally retouched on the dorsal surface by notching. Crushing is evident in the notches from manufacture and/or use. The snapped off tips indicate these were the primary working parts of the tool that were possibly used as borers or awls (Figure 5.6).

From layer 11 there is one unifacial tool, #2978 (Figure 5.6). Both dorsal edges of the blade-like flake are unifacially retouched. These edges meet in a point or tip at the proximal end of the original flake. This tip exhibits crushing from use. Nibbling and step-terminated scars along the edges indicate use, possibly on medium or hard materials (e.g. wood or bone). A concavity and crushing on the left dorsal side matches crushing on the ventral surface on the right side. This suggests a hafted area for holding the tool while it was twisted, using the pointed tip. This twisting would have been in a counterclockwise direction.

A dorsally retouched uniface from layer 12, #1618, has two rounded corners made by the intersection of three straight chipped edges (Figure 5.6). Two of these edges, on the right and left proximal sides, are flaked back 8 to 10 mm from the edge and extend 15.3 mm and 16.4 mm, consecutively. The third edge, located midway along the left side, is only about 9.5 mm long and retouch extends about 10 mm in from the edge. This tool is made from a coarser, white and dark gray, mottled SRC. Feather and step-terminated scars at the rounded

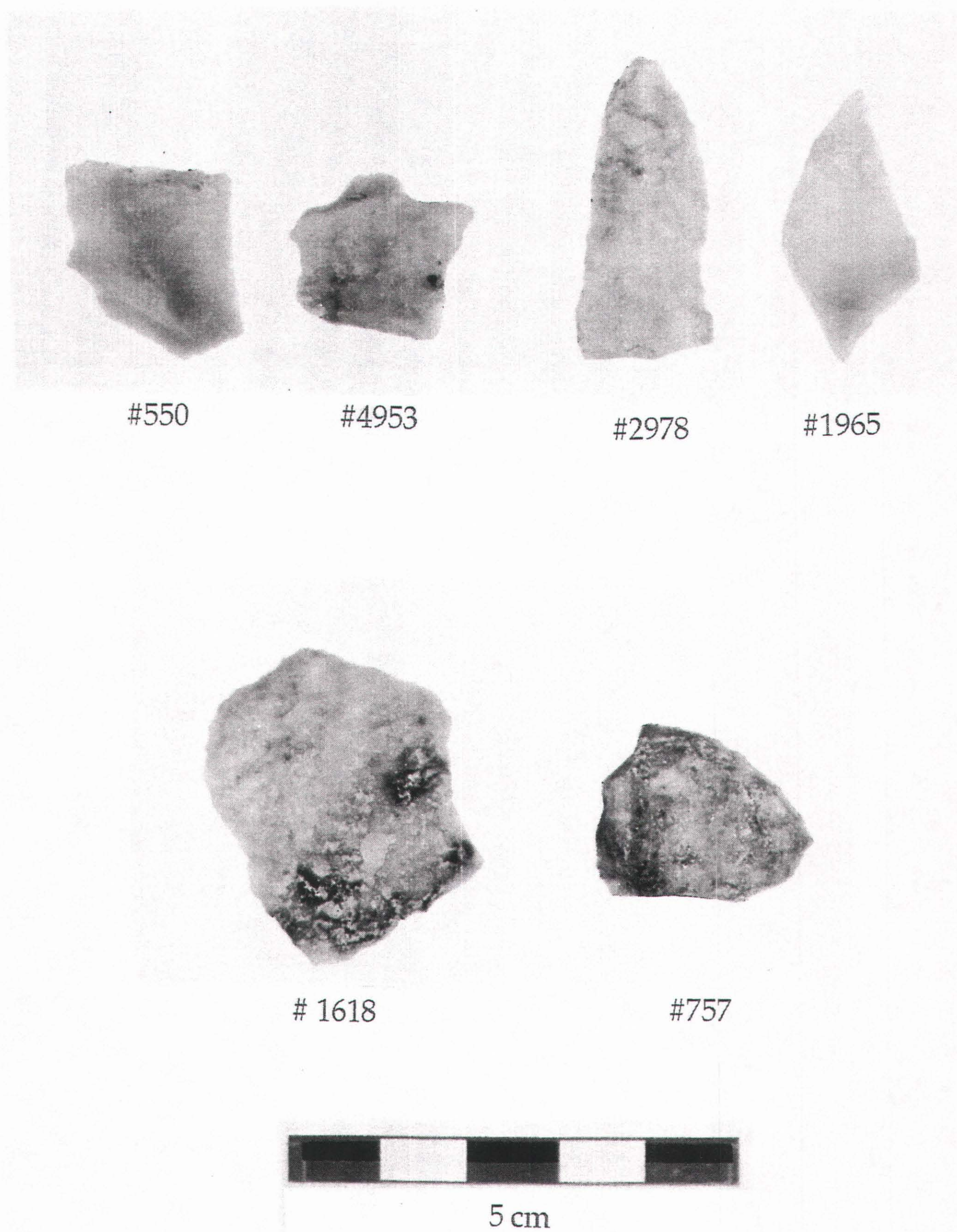


Figure 5.6 Other unifaces from the Redtail site

and obtuse angled (126° and 112°) corners suggests that they were used in working softer and/or medium hard materials. The edges are relatively sharp, and only the right proximal edge has been retouched. Some minute scarring suggests that these edges may have been minimally used.

Layer 13(2) has three items in the unifacial category. Catalogue #1965 is a fragment with one worked and one utilized edge (Figure 5.6). It is made from a very fine-grained, somewhat translucent, white Swan River chert, as is indicated by two "drusy" vugs. Rather steep (60° to 65°) retouch extends about 3 mm in from the edge on the dorsal surface. The worked edge extends 22.6 mm and is straight when viewed from the dorsal perspective but is concave when viewed in cross-section. It has been snapped at one end of the working edge and at the other intersects with a utilized edge at a 118° angle. The tool thickens at the intersection of these edges and crushing use-wear is most pronounced at this rounded corner, though crushing and nibbling is present along both edges on the dorsal surface only.

Another uniface, #757, can best be described as a complete endscraper (Figure 5.6). It was made from a pink and white mottled Swan River chert. The original striking platform and preparation for the tool's flake blank is still apparent. This preparation included chipping, crushing and some grinding/rounding. The convex working edge is located distally and angles across 23.2 mm to the right side. Dorsal retouch extends about 5 mm back from the edge at a 68° to 72° angle. Step-terminated use-wear scars and crushing is predominant along the working edge, while no rounding or polishing is apparent. Based on Brink's (1978: 65-71) experimental results, the use-wear on the endscraper may have occurred due to use on wood or other medium hard material. It certainly seems not to have been used on hide or softer materials, at least at the end of its use-life.

The last uniface tool to be discussed is #550 (Figure 5.6). It is a nearly complete flake that has been retouched on two straight edges that intersect at a 98° angle to produce a sharp corner. This tool is made from a fine-grained, creamy white piece of Swan River chert. The length of the retouched edges are 17.8 mm on the left and 18.4 mm on the right side. This retouch extends about 2 to 3 mm back from the edges, and forms an edge angle between 58° and 61°. The pointed corner has a shallow dorso-ventral angle of 48°. Some crushing and nibbling has occurred along both working edges to produce a jagged profile. Such wear suggests use on materials of a medium hardness, such as wood. The very tip of the corner has been broken off, and no other use traces are apparent at the corner area. This suggests, by the process of elimination, that the corner was used on softer materials that would leave fewer traces of use-wear.

5.6.6) Marginally Retouched Stone Tools

Nine marginally retouched stone tools were identified. These items have either edge retouch or use-wear usually on an otherwise unmodified flake or shatter. There are six of these in layer 12 and three in layer 13. Some metric attributes and provenience information are presented in Table 5.12.

The first of the layer 12 tools to be discussed includes two pieces that can be refitted, #1882 and #1883 (Figure 5.7). These represent different stages of use for the same tool. This item is a large (36.9 mm by 43.2 mm) flake that was utilized along a straight distal edge. It is made from a coarse, gray and white SRC. The distal working edge was formed by removal of a transverse flake from the edge and dorsal surface. This 52° to 54° edge was then used, as reflected by crushing, rounding and a few step-terminated microflake scars on #1882. This piece is a larger flake (34.5 mm by 23.8 mm) removed as a transverse flake from across the utilized edge of the larger flake tool, #1883. Then the larger (#1883) piece continued to be utilized. Its working edge is rounded from use and has

Table 5.12 Redtail Site Marginally Retouched Stone Tool Metrics and Nonmetrics

Unit/Layer	Layer	Cat. #	Weight (gm)	Material	Length (mm)	Width (mm)	Thickness (mm)
120N 110E	12	3103	4.8	SilWd/Ht	31.7	21.2	6.3
120N 110E	12	3104	2.5	SilWd/Ht	25.5	19.8	4.6
121N 110E	12	4994	7.3	SilPt	45.4	19.5	7.4
123N 107E	12	4394	0.8	SRC	20	8.5	6.9
121N 105E	12	4951	10.9	SRC	31.6	32.2	10.9
122N 111E	12	1882&1883	17.7	SRC	36.9	43.2	9.1
124N 109E	13(1)	3774	2.2	Chert	36.2	17.3	5.2
123N 114E	13(2)	354	11.9	SRC	38.9	28.5	11.9
124N 109E	13(2)	4965	5.5	SRC	32.9	23.3	6.6

Cat. #	# Worked Edges	Worked Edg Lth (mm)	Type	Edge Shape	Edge Angle (Degrees)
3103	1	22.8	Biface	Convex	76
3104	1	14.6	Util	Strt & Conv	47
4994	1	45	Biface	Cnvx	72-75
4394	1	7.9	Util	Indeterminate	32-33
4951	1	17.8	Util	Straight	55-56
1882&1883	1	42.2	Util	Straight	52-54/41-42
3774	1	31.5	Uniface	Strt/SlCnvx	40
354	2	26.7&22.1	Unif/Biface	Serat & Backed	55-58
4965	2	12.3&11.0	Perf/Graver	Tipped	37

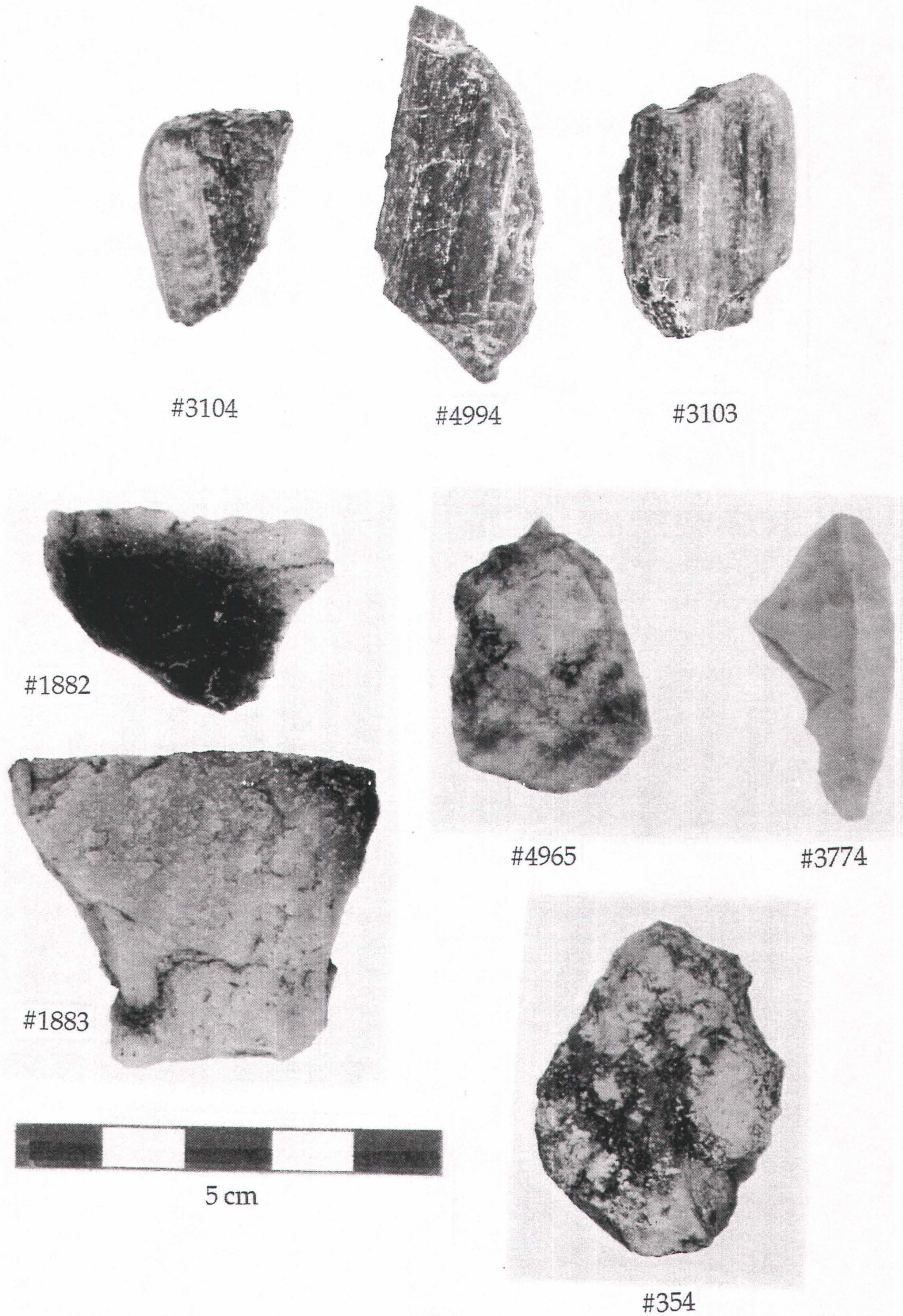


Figure 5.7 Marginally retouched stone tools from the Redtail site

many step-terminated microscars. Because lithic material is durable and the nature of the use-wear on this tool, it was probably employed in modifying harder materials such as antler, bone or wood.

Catalogue #3104 is a retouched decortication flake removed from a piece of heat-treated silicified wood (Figure 5.7). Retouch extends 3 mm to 4 mm back from the edge and runs continuously for 25 mm along one edge. It has retained a sharp edge. Though some crushing is still evident toward one end this may remain from initial preparation of the edge for flaking. The edge is straight to slightly convex and has a steep angle of 72° to 76°. No use-wear is apparent.

Catalogue #3103 is very similar to this latter specimen. It is a bifacially worked piece of heat-treated silicified wood. It has a convex working edge about 22.8 mm long that has a steep 76° angle. The working edge is still relatively sharp and there is no apparent use-wear. The specimen is a split portion from a silicified wood tablet, with the cortex remaining on the dorsal surface and the ventral scar surface in primary scar condition, except on the one working margin of the tool.

Catalogue #4394 is a small triangular fragment which has a short, about 6 mm, of working edge evident. It is made from a finer quality white Swan River chert. The tool is relatively thin, 7.0 mm, and is snapped along two of its three edges. One surface may have been secondarily retouched but the other is only primary retouch. With such a shallow edge angle (26°) and fine lithic material, many materials could have caused the crushing wear.

Catalogue #4951 is a thick (10.9 mm) flake that was utilized along the distal edge. The original flake's striking area is still evident with two larger, 5 mm to 10 mm long, step-terminated scars on the dorsal surface. The flake is made of a white and pink, coarse quality SRC. The slightly convex working edge was produced by two transverse flakes along the edge and ventral surface.

Utilization along the 17.8 mm and 55° working edge has produced nibbling and some step-terminated scars but the edge is still fairly sharp. Such wear may indicate short use on medium hard materials such as wood or dried hides.

Catalogue #4994 is a piece of silicified wood with a naturally polished dorsal cortex of the original cobble's surface (Figure 5.7). It has about 52 mm of convexly curved working edge. The bifacially retouched edge was battered, with extensive step-terminated scars and much of it is crushed and rounded. This might be from preparation. The piece is thin and retouch extends continuously along the entire edge. This suggests that the tool was completed for a specific purpose. It would seem to have been used on hard materials, such as antler, bone or wood.

Catalogue #3774 is an unifacially retouched blade-like flake from layer 13(1) (Figure 5.7). It is made of a very fine quality, creamy white Swan River chert. The convex working edge extends about 25 mm along the left edge of the flake, paralleling a dorsal ridge. Retouch and use-wear extends 1.5 mm to 2.5 mm in from the edge on the dorsal side. Most retouch terminates in feather scars but some have step-terminations. Use-wear is evident as small step-terminated scars and nibbling, although with a shallow angle (40°) and the fine material used, the wear could have been caused by use on softer or medium hardness materials.

Two marginally retouched tools were found in layer 13(2). The first of these, #354, is a thick flake retouched on both edges (Figure 5.7). It is made from a variable quality piece of pink, white and gray Swan River chert. The left edge has bifacial shaping retouch to shape and it was then heavily rounded or "backed". On the right side some larger (7 to 11 mm long) retouch flakes are removed to produce a nearly serrated edge. Nibbling and slight smoothing suggests use on softer materials, such as the cutting of meat, sinew or softer plant materials.

Catalogue #4965 is retouched at the proximal end of a flake to produce a pointed tip (Figure 5.7). It is made from a fine quality, gray and white SRC. Both sides and the distal edge are purposefully blunted by a combination of the removal of burin-like spalls and retouch with subsequent rounding or "backing". Bifacial retouch at the proximal end produced a tip that is 77° from the dorsal perspective and 37° dorso-ventrally. The tip and adjacent edges are smoothed or slightly rounded. This may suggest a function as a graver, punch or borer for use on softer materials, such as hide or leather, but does not rule out use on materials of medium hardness (e.g. softer woods or bark).

5.7) Granular Lithic Tools

There are 14 granular lithic tools in the Redtail site's layers 8 through 15 (Table 5.13). Three of these are from layer 8, two from layer 11, five from layer 12 and four from layer 13. These include tools that functioned as anvils, hammers, choppers, abraders and had other multipurpose functions. These tools are included in this category based on their coarser or granular material types, such as granite, gneiss, diorite and basalt. However, there are also some tools in this group because of their larger size, and some of these are made from relatively finer grained materials such as sandstone and quartzite.

The first of these tools to be discussed, #4950, was the only one found in layer 8(1) (Figure 5.8). It was used as both a hammer and anvil, then became a FBR or was discarded in a fire. This tool is made of a quartzite cobble about 115 mm long, 56 mm wide and 49 mm thick. One end has been extensively used as a hammer/anvil with a battered area about 27 mm by 19 mm. This same end also has a hole 8.6 mm by 9.8 mm in diameter and over 10 mm deep. The hole is coarse and granular inside, not smooth. It is possible that this hole may have

Table 5.13 Redtail Site Granular Stone Tools Metrics and Nonmetrics

Cat #	Unit	Layer	Material	Descript/ Function	Length (mm)	Width (mm)	Thick (mm)	# Use Area(s)	Size(s) Use Area (mm)	Weight (gm)
4950	120N 107E	8(1)	Quartzite	Ham/Anv	115.3	56.0	48.9	4	10 to 21	457.1
2984	120N 110E	8(2)	Granite	Ham	100.1	75.0	53.7	1	16 by 14	527.2
3781	124N 108E	8(2)	Granite	Anv	160.0	137.7	97.4	4	6 to 24	2607.7
3009	120N 110E	11	Quartzite	Smoothed	95.3	64.5	36.6	1	62 by 49	311.0
4500	122N 108E	11	Granite	Anv	99.9	66.3	42.4	3	11 to 25	417.0
1617	124N 111E	12	Diorite	Ham/Anv	66.6	44.6	34.4	3	8 to 20	141.7
1907	122N 111E	12	Granite	Ham/Anv	124.4	88.8	68.0	3	13 to 24	1147.7
3096	120N 110E	12	Bslt(Por)	Cho/Ham	73.5	58.4	30.3	1	69 edge	180.1
4960	124N 109E	12	Lmstn	Bif-?	188.7	94.9	30.7	1	arc edge	723.1
4961	122N 106E	12	Quartzite	Ham	104.9	78.9	49.6	2	8 to 20	561.6
3751	121N 109E	13(1)	Arkose	Abrader	39.8	31.1	27.0	1 groove	10 by 24	30.8
1775	123N 111E	13(2)	Gneiss	Smoothed	107.5	83.0	39.1	1	47 by 45	504.6
2360	124N 110E	13(4)	Quartzite	Cho/Ham	85.6	64.4	37.2	3	8 to 25	230.3
2976	123N 113E	13(4)	Quartzite	Ham	133.5	70.4	46.4	3	12 to 90	616.2

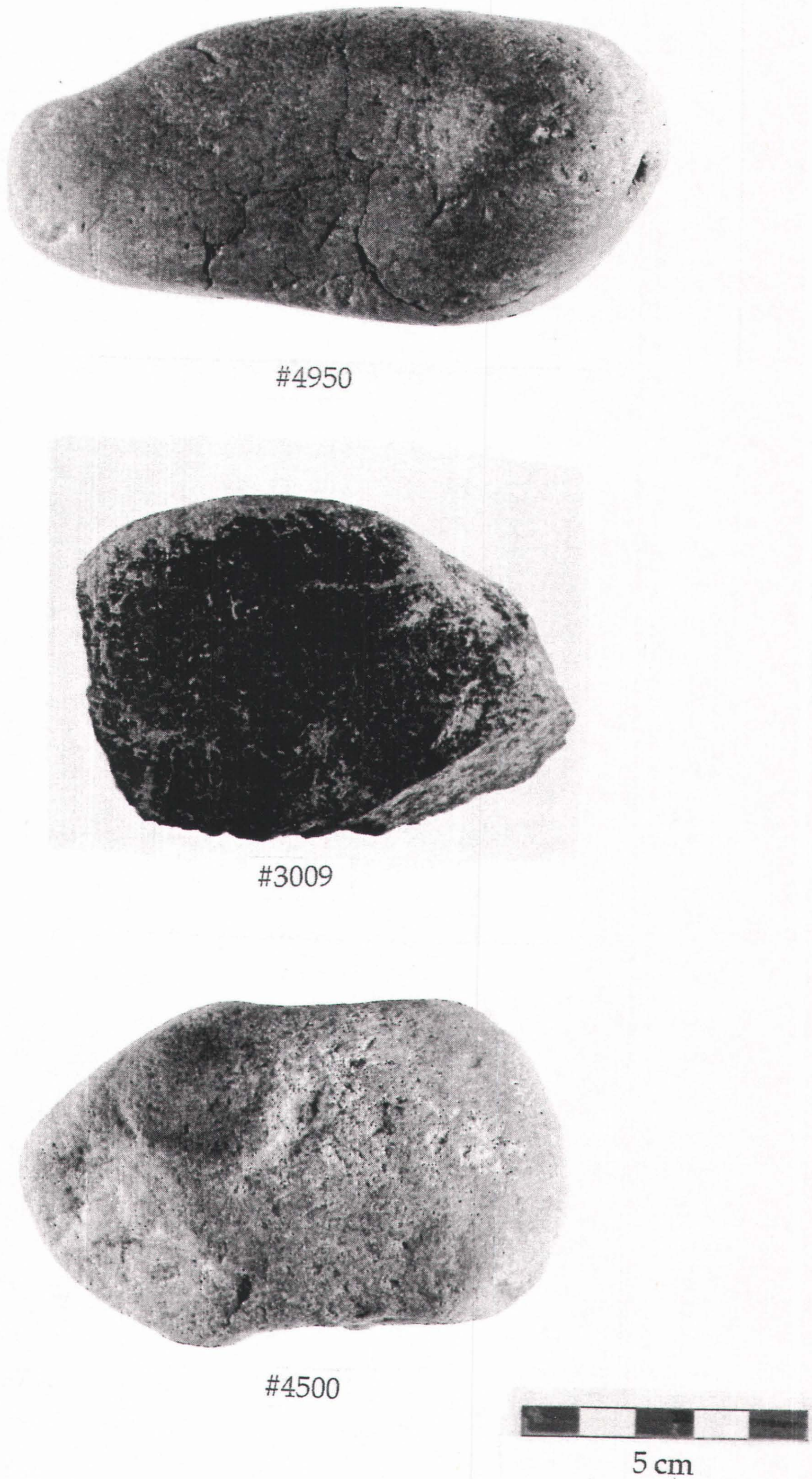


Figure 5.8 Layers 8 and 11 Granular Stone Tools

housed a natural crystal inclusion which fell out (David Meyer, personal communication 1992). The opposite end has moderate use as a hammer/anvil with battering concentrated in a 12 mm by 14 mm area. Three areas on the sides are pocked due to use as an anvil. One area is a dense concentration 13 mm by 16 mm, while the other two are spread out over areas of 10 mm by 21 mm and 16 mm by 21 mm.

In layer 8(2) there is one hammer, #2984, and one anvil, #3781. The hammer is made from granite and was minimally battered in a 16 mm by 14 mm area on one end. However, the anvil was more extensively used. It is made of granite and has four concentrations of battering: 17 mm by 18 mm, 6 mm by 13 mm, 24 mm by 21 mm and 20 by 18 mm.

Layer 11 has an anvil, #4500, and a grinding base, #3009 (Figure 5.8). The anvil is made from granite and has pocked areas on two surfaces. One surface has two, heavy, pocked concentrations 19 mm by 25 mm and 11 mm by 11 mm in size. The other surface has a loose clustering of pock marks in a 27 mm by 19 mm area. The other grinding base/abrasive tool appears to have a smoothed area about 62 mm by 49 mm in area on one surface. This utilized quartzite cobble could have functioned in grinding up seeds or rodent bones, preparing edges of other tools for flaking, or any number of other functions.

Layer 12 has five tools with multiple functions as hammers, anvils and/or choppers. One combination anvil and hammer tool, #1617, is made of diorite (Figure 5.9). It was more extensively used as an anvil, particularly in two areas 20 mm by 18 mm and 9 mm by 10 mm. The battered hammer area is limited to a 8 mm by 10 mm area. This cobble is only 67 mm long and weighs 141.7 grams, which might be considered a small anvil.

Another combination hammer and anvil, #1907, is made from granite (Figure 5.9). This tool has two areas, 13 mm by 13 mm and 23 mm by 24 mm,

#1617

5 cm

#1907

5 cm

Figure 5.9 Layer 12 Hammer/Anivil Combination Tools that are battered, possibly in use as a hammer. One area was minimally used as an anvil, some 19 mm by 17 mm in size. This tool weighs a hefty 1147.7 grams.

A fragment of a chopper or hammer, # 3096, is made from porphyritic basalt (Figure 5.10). It is extensively battered for 69 mm along an edge. This tool may have functioned in working harder materials such as flaking lithic tools or breaking long bones to remove their marrow.

A bifacial chopper, #4960, is made of limestone (Figure 5.10). It was bifacially retouched in a half circle and broken across the diameter. The edges are rounded, possibly from use on softer materials. The tool is not polished. It weighs 723.1 grams and is 30.7 mm thick. One surmised function is that it may have been used in digging/scooping out pits or hearths (based on association with several scooped out hearths and pits).

The fifth tool in layer 12 is a quartzite hammer, #4961. This cobble is battered, with chips removed, and pocked in two areas, one 19 mm by 11 mm another 20 mm by 8 mm in size.

Layer 13(1) has a fragment of a grooved abrader, #3751, made from a conglomeratic coarse sandstone (Figure 5.11). The groove is 10.5 mm across, 7.2 mm deep and extends 24.3 mm. It seems as if the groove extended farther in either direction but was broken off at both ends. Finnigan *et al*. (1985: 9-18 to 9-19) would define this as a shaft smoother. However, it is not a symmetrically rounded groove. It is straighter on one edge, rounded on the other, and tends to be narrower at one end and opening slightly at the other (e.g. 10.5 mm to 12 mm diameter). Crabtree (1972) has identified similar items as a tool for honing wooden or antler tools for flaking lithic materials. Either or both functions may have been the case (see Flenniken and Ozbun 1988).

In layer 13(2) there is a grinding base, #1775 (Figure 5.11). It has some smoothing, 47 mm by 45 mm in size, on one flat surface of the gneiss cobble.

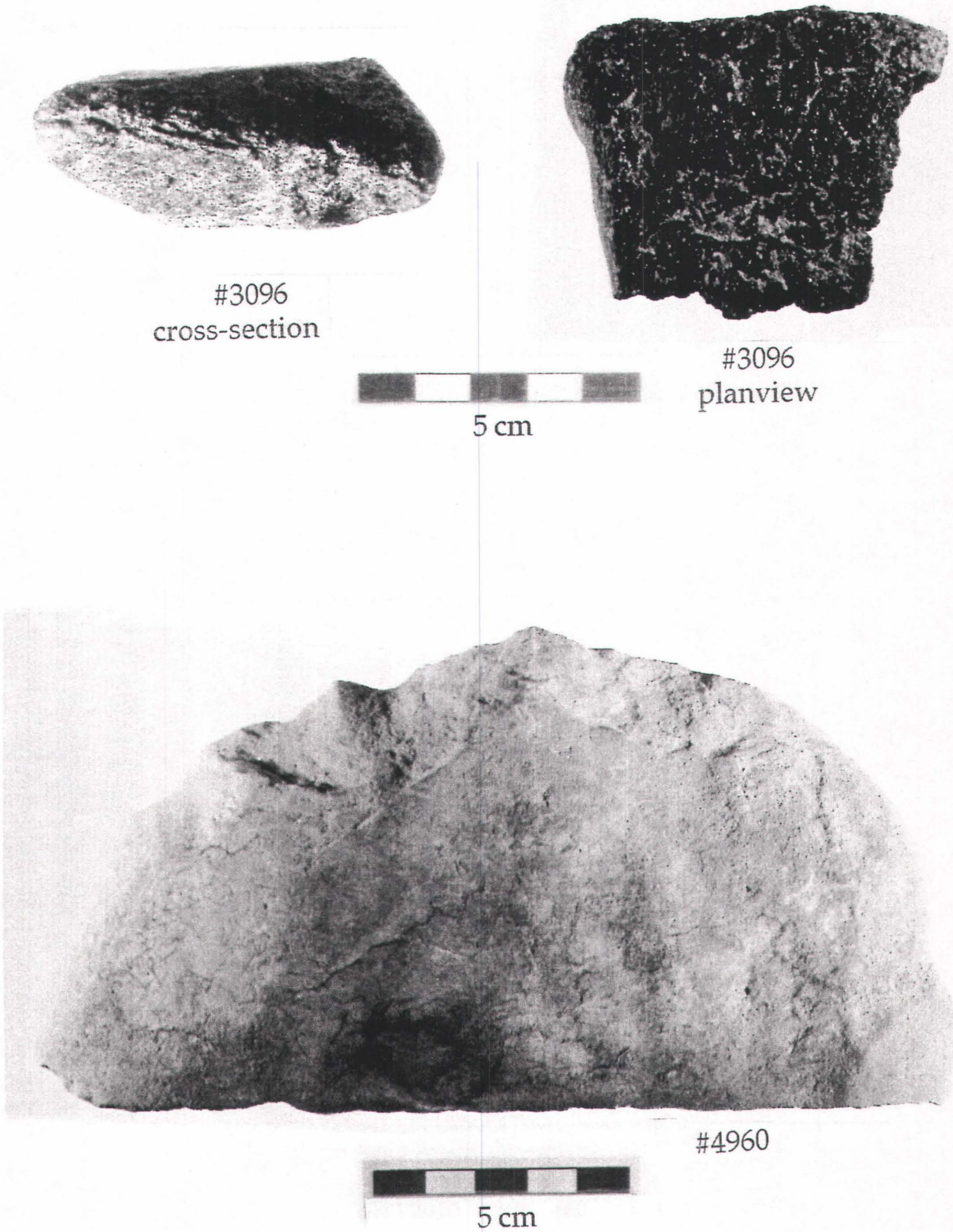


Figure 5.10 Layer 12 Chopper and Biface Tools

#3751
cross-section

#3751
planview

5 cm

5 cm
#1775

Figure 5.11 Layer 13(1) and 13(2) Granular Stone Tools

This may have been used in edge preparation of chipped lithics, plant or bone reduction, hide processing, or similar activities that would smooth a large coarse stone (see Adams 1988). It has not, however, been extensively used.

Two tools recovered from layer 13(4) include #2360, a chopper/hammer, and #2976, a hammer (Figure 5.12). Both are made from quartzite cobbles. The first of these, #2360, was extensively used as a chopper on one end as indicated by a chipped and battered 25 mm edge. On the other end, this tool has two moderate concentrations of pecking, 22 mm by 11 mm and 8 mm by 15 mm, indicating use as a hammer or anvil. The other hammer, #2976, has pecking marks on both ends, 23 mm by 30 mm and 36 mm by 15 mm, in addition to battering along one edge, 12 mm wide by 90 mm long.

5.8) Bone Tools

Much of the bone assemblage is weathered (see Chapter 4). This obscures utilized surfaces, and results in naturally rounded and polished edges which may be confused with utilized edges. A judgmental process was used in differentiating which is which, and is based primarily on localization of polish, degree of polishing, shape of edges and comparison with the rest of the bone specimen's surfaces. No definite tools are identified. Four bones are identified as possible tools, and are discussed summarily.

In layer 11 two pieces, catalogue #3553, weigh 4.0 gm and that fit together to form part of an indeterminate mammal rib midsection. There is some polish on one end of these. A larger (78.1 gm) bison radius fragment (#648) from layer 12 appears to be differentially polished on one edge. Layer 12 has a small (1.2 gm), possible canid, metapodial fragment (#2032) that appears to be modified (Figure 5.13). Layer 13(2) has two indeterminate mammal rib fragments (#2955 and #2956) that weigh 4.4 gm and fit together. These have been whittled, scored and smoothed (Figure 5.13).

5 cm

5 cm

#2976

Figure 5.12 Layer 13(4) Granular Stone Tools

Figure 5.13 Culturally Modified Bone from the Redtail site

5.9) Summary and Discussion

This chapter describes the FBR, debitage, cores, chipped lithic tools, large or coarse stone tools and bone tools for layers 8 through 15 of the Redtail site. Such data can provide insights about cultural activities during the different occupations, but may also reflect the cultural variation through the time span represented by these layers. Some general assemblage information and layer by layer artifact frequencies are presented in Appendix B, Table 4.

Layer 8(1) has only one hammer/anvil tool. Layer 8(2) contains both a hammer and an anvil. Overall, layer 8 has little FBR and chipped lithic materials. The few chipped lithics present may reflect activities of biface thinning. A ratio of flakes to shatter of 1.5 to 1 may support this. However, flakes may also have been used as expedient tools.

Layer 9 has no tools. There is a small amount of FBR in this layer but it seems to be heavily utilized. The more intense weathering processes in this layer may also have further reduced the FBR. Though few chipped lithics are present, two cores and a moderate Cortex Index indicate some initial lithic reduction.

Layer 10 contains two chipped unifacial tools, a borer/awl and a sidescraper. Fire-broken rock is moderately reduced. Though few chipped lithics are present, some lithic reduction is indicated by a moderate Cortex Index, a spent core and some bifacial thinning flakes. The ratio of shatter to flakes is nearly equal.

Layer 11 contains one projectile point body portion which is a probable Hanna type. Other items include an ovate bifacial preform and an unifacial perforator tool which was possibly used on harder materials such as wood or bone. An anvil and a ground and smoothed stone are also in this occupation. Fire-broken rock is moderately reduced. This layer has a large amount of lithic debitage, with a low to moderate amount of cortex represented. The frequency of shatter is three times that of flakes, and may suggest more use of hard hammer percussion. In this layer, there is only one large core that has three striking platforms. The overall lithic debris and amount of large shatter suggests that some of these may be fragmented cores.

Layer 12 contains the most lithic material of all the layers. Six projectile points are identified. Three are of the Hanna type while the other three are indeterminate, shallow-notched forms. The three complete points all indicate reworking, rejuvenation or alternate uses. Notching of some tools may reflect the use as knives and reworking of points into other tool types that require a different haft form. Even some of the Hanna type tools have worn "notching" areas along their stem, likely from re-use as knives.

Layer 12 also has two large, hafted, pointed bifaces fragments, including a tip and a hafted base. The base fragment has the size and thickness of a large, hafted knife or a thrusting spear. Another biface is represented by two fragments which indicate a large, relatively thin biface, possibly utilized on softer materials such as meat or hide.

Two complete small, hafted, pointed unifaces are also recovered from layer 12. The larger one is worn, on the sides and base, from use on softer materials, such as fresh hide or nonwoody plants. The small one appears unused and is so small it is toy-like. Though these both appear to be projectile points (e.g. stem morphology is Hanna-like) they seem to have had other functions.

Also, from layer 12 there is one uniface with three minimally used edges intersecting to form two rounded utilized corners. Wear suggests use on medium to hard materials such as wood or bone. There are also six marginally retouched tools. Three of these indicate use on medium to hard material. One of these, a large utilized flake, was transversely flaked across the working edge three times to make a new sharp edge. The others were used on softer materials or minimally utilized.

Five larger granular stone tools were found in layer 12. These include two hammer/anvils, one combination chopper/hammer, another chopper and a hammer. These were probably utilized in lithic production, due to the abundant lithics in this occupation, and may also have been used in animal carcass processing.

There are many retouch or sharpening flakes in this layer. This indicates cutting, slicing and other activities that dull flaked stone tools took place and required their sharpening. There are low to moderate amounts of cortex represented, indicating some import of previously decorticated cores. There are 20 cores identified from this layer, and half are reduced or have multiple striking platforms. The overall mass of lithic debitage indicates the importance of lithic production in this layer. The frequency of shatter is over three times greater than the frequency of flakes. This may reflect the coarse lithic materials (e.g. quartz and quartzite) in this layer and that hard hammer percussion was a predominant method of reduction. Fire-broken rock in layer 12 is extensively utilized and very abundant compared to the other layers.

Layer 13(1) has one large, hafted, pointed biface that is Hanna-shaped in morphology, but it is so large that it was likely used as a hafted knife or perhaps as a spear point. Another small triangular biface fragment and a unifacially retouched blade-like flake complete the chipped tools for this layer.

The grooved abrader was also recovered from this layer. It may have been used as a "shaft-smoother" and for the honing of wood, antler or bone knapping tools. The great amount of lithic production, and sharpening flakes in this layer, support both interpretations.

FBR is extensively used in layer 13(1). Retouch or sharpening flakes make up a considerable amount of the overall chipped lithic remains. Thus, the reworking of tools was a more prominent activity in this occupation. On the other hand, this layer has the highest Cortex Index, which may indicate import of primary, unreduced cores to the site for reduction. This is also reflected by four reduced cores and the great amount of lithic debris. Shatter is nearly equal in number to flakes and generally reflects the combined sequence of activities from initial core reduction stages through to finer tool retouching or manufacture.

Layer 13(2) has two projectile point basal fragments of the slightly stemmed variety of McKean Lanceolate or possibly Duncan types. On one of these the blade edges are rounded, indicating that it may have been utilized as a knife. One large thick pointed biface tip has been used on hard materials. Three unifaces include a slightly concave edged tool, an endscraper, and two perforator tools. All these have been used on medium to hard materials such as wood or bone. Two other marginally retouched tools include a semi-serrated edged flake with an opposite backed edge and a boring tool with blunted/removed edges for easier handling.

The only large granular tool in layer 13(2) is a grinding base with smoothed areas. A considerable amount of FBR is present and is substantially reduced. Sharpening flakes are also well represented in this assemblage. The Cortex Index is moderate, and two of the six cores have multiple platforms. Shatter is about equal to the number of flakes. These aspects are similar to layer 13(1) overall and may reflect some mixing of the layers, which are arbitrarily separated in much of the upper block. However, there is enough material for each of these layers and enough separation in the lower block to adequately consider these as distinct assemblages.

Layer 13(3) has a large pointed biface tip, its only chipped tool. No granular stone tools were recovered from this layer. FBR is only moderately used. The chipped lithics present contained a higher percentage of resharpening flakes, a high Cortex Index and had a notable number of bifacial thinning flakes. Thus bifacial manufacture may be one of the dominating lithic activities. These indices, however, represent a considerable range of lithic importation, production and maintenance activities. But the low amount of debitage indicates that these activities are quite limited.

Layer 13(4) produced two McKean Lanceolate type projectile points. Of the two other bifaces from this layer, one has a minimally used edge and another is a thin broken tool that has a formed square end with residue. Two granular stone tools include a combination chopper/hammer and a hammer. Fire-broken rock is infrequent, reflecting limited use of this material. This may also suggest a different use of FBR in this layer. This layer has three unreduced cores. The flakes outnumber shatter about 2:1, which may indicate a greater use of soft hammer percussion.

Layer 14 has no chipped or granular stone tools. There is less FBR but it is well utilized. The few chipped lithics suggest a high Cortex Index and bifacial thinning may be reflected. This may suggest some biface manufacture occurred or else production of flakes for use as expedient tools. Layer 15 has no formed tools or FBR and only a few flakes are represented.

This concludes the discussion of artifacts from layers 8 through 15. The artifact variation between layers has provided some tantalizing perspectives about human activities at the site. Some variation is reflected between assemblages. Differences may indicate varying use of hard hammer or soft hammer percussion techniques, variation in quality or types of lithic raw material, and/or the range of the production sequences carried out at each occupation. The few projectile points and other formed tools suggest some differences in style. However, the meager numbers of such possible "diagnostic" materials considerably limits the interpretive strength of these differences.

CHAPTER 6

Redtail Site Fauna

6.1) Introduction

The fauna from the Redtail site is predominated by bison remains. However, some layers contain deer, antelope, canid, mustelid, lagomorph, rodent, aves and other animal classes. Over 21,370 bone pieces weighing about 40 kg were catalogued from layers 8 through 15. Most of the material, some 18,877 pieces or 32 kg, is from layers 10, 11, 12 and 13.

In this chapter, a review of the methods employed in the Redtail site faunal analysis is followed by general descriptions of the recovered faunal assemblages. A specific discussion of identifiable remains follows this, beginning with the larger ungulates. Then the mid-size to smaller mammals, birds, amphibians and other animals will be described. Measurements and gender analyses are presented for some of the complete and nearly complete bison remains. Raw data measurements are provided for other researchers to use for general intersite comparisons or bioarchaeology, but the sample size is too small for strong intrasite comparisons. The discussion synthesizes the salient information of each assemblage's fauna and its potential seasonal indicators.

6.2) Faunal Analyses Methodology

The cataloguing program used was developed by Ferris (1989). Presence of weathering on bone is noted. The amount of burned bone and which identifiable bones are in each layer also provides clues as to which processes have dominated in the decomposition of bone. All identifiable bone materials are analyzed using a specialized MacAdem 10.1 FNL computer program developed by Gibson (1991). McKeand and Gibson (1992) have refined the menu to include most diagnostic identifiable parts. Long bones are subdivided into proximal, proximal/medial, medial, medial/distal and distal categories. The menu choices include complete, nearly complete and fragment categories. The "nearly complete" category of identifiable bones is employed so that they can be used for Minimum Number of Individual (MNI) determinations. For example, "nearly complete" means that the majority, or between 55% to 95%, of that element or diagnostic bone portion is represented. The MNI is also adjusted to reflect the maturity of bones. For example, an estimated one month old left distal bison tibia and an estimated seven month old right distal bison tibia may be counted as two MNI for immature bison. This is similar to Flannery's approach (1967: 132-178) as described by Grayson (1984: 35). Bison aging estimations employ the University of Saskatchewan's Department of Anthropology and Archaeology faunal collection, Brumley's (1990) tooth eruption and wear schedules (TEWS) and Frison and Reher's (1970: 46-48) aging categories.

The Number of Individual Specimens (NISPs) are also presented for identified fauna in each layer. These data provide a "feel" for the contents of each layer and reflect how much each layer has been taphonomically reduced. Consideration is given to Grayson's (1984: 1-26) review of NISPs.

Some effort is made to measure complete or nearly complete bone specimens that may be used for larger comparative analyses by other researchers. These may also provide some limited hints toward gender identifications. Walde's (1985) approach is used for long bones. Morlan's (1991) measurements are provided for the carpals and tarsals, but determinations are not possible due to the small sample size. These are provided for use by others in larger intersite or bison time-population studies.

6.3) General Faunal Characteristics

There is some variation in the percentages of identifiable and burned faunal remains between layers. These data are presented for each layer in Table 6.1. Those assemblages with the least percentage of identifiable materials include layers 8, 9, 10, 11, 12 and 13, which range from 10% to 24%. Layers 14 and 15 have higher percentages of identifiable remains, 41% and 29% respectively. Some sublayers have higher percentages of identifiable bone compared to their combined layer. This is probably because identifiable bone is more likely to be point provenienced, and thus is more separable into sublayer provenience. Overall, the greater the difference between sublayer totals and the comprehensive layer totals, the greater the likelihood that this methodological factor is influencing the percentages. This seems to be the case for layer 8 in particular, and perhaps less so for layers 13 and 14.

Table 6.1 Percent Identifiable and Burned Bone Per Layer

Layer	Identifiable Bone % by No.	Burned Bone % by No.		Total Bone Number	Total Bone Wt. (gm)
8	20	27		1035	4283.6
8(1)	38	14		257	1663.2
8(2)	46	15		179	2114.4
9	24	2		138	569.5
10	18	10		2644	4004.9
11	16	26		3333	9713.6
12	16	22		6672	6851.9
13	15	35		6228	11166.6
13(1)	14	28		1801	3214.7
13(2)	14	41		3531	5821.6
13(3)	20	46		351	473.2
13(4)	29	14		303	1336.3
14	41	4		1177	2533.0
14(1)	33	21		173	309.9
14(2)	47	0.2		498	1002.1
14(3)	44	0.5		200	675.3
15	29	0.7		143	445.7
AVERAGES:	22	16	TOTALS:	21370	39506.4

Note: Identifiable bone includes elements identified for "indeterminate mammals" and "indeterminate ungulates", therefore, these percentages are greater than the totals for just species level identifications reflected by NISPs.

Generally, layers with more total faunal remains also tend to have lower percentages of identifiable faunal remains. This may indicate that the layers with more faunal remains also contain a larger repertoire of bison skeletal remains, perhaps including more easily decomposed axial and skull portions. A greater number of bison killed at or near the site would result in many more bone fragments than only a few imported denser bison limb bones. Thus, a greater amount of unidentifiable bone percentages may, to some degree, reflect the greater amount of porous or thin bone units from bison (e.g. vertebrae, scapula, pelvis and skull). These would easily decompose into fragments with the subsequent weathering processes so prevalent at this site. In contrast, importation of higher valued, large ungulate limbs for marrow and meat (Wheat 1971, 1979), are denser and therefore deteriorate less easily. This may result in a higher percentage of identifiable remains (see Lyman 1992; Lyman and Fox 1989).

Varying element dispersion by human, canid and other natural processes acting on remains on a slope can also lead to differentiation of bone samples represented between the different layers. This may be the explanation for high identifiable bone percentages in layers 9 and 14 - two layers noted for greater weathering of bone remains. The reduction or removal of smaller unidentifiable bone by natural processes would seem to have escalated the percentage of identifiable bone for these layers. The larger, more identifiable, bones, however, were more resistant to weathering and were less likely to be transported downslope due to their higher density and weight. Bison limbs may have also been imported for use. This may explain the higher amount of identifiable remains.

Thus, variation is due to the differential taphonomic processes between layers, the bone type/taxon's resistance to weathering and gnawing (Lyman

1984; Lyman and Fox 1989) cultural factors (Brumley 1973; Lyman 1978; Todd and Rapson 1988; White 1952, 1953, 1954) and/or methodological factors. The lower percentages of identifiable materials in some layers may reflect cultural factors such as increased processing by humans, killing animals at the site (vs. importation of more durable limb bones), kills during seasons of rapid decay (e.g. spring/summer vs. fall/winter) or human trampling (see Binford 1981; Gilbert 1969; Hill 1979; Jones and Metcalf 1988; Vehik 1977). Natural taphonomic factors which may cause a similar pattern include rodent and/or canid gnawing, ungulate trampling, freeze/thawing, microbial activity, plant rooting deterioration, water channel/slope erosion/dispersal, and cation exchange (see Gifford 1978; Hanson 1980; Hill 1980; Carbone and Keel 1985; Wood and Johnson 1982).

Human activity is more likely reflected by the percentage of burned bone materials in each assemblage. Percentages of burned bone per layer are presented in Table 6.1. Some layers, such as 8, 11, 12, 13 and 14(1) have higher percentages of burned bone. These layers also indicate lower percentages of identifiable bone and thus cultural processes would be a greater factor in bone decomposition in these layers (in addition to the natural processes).

Other layers with lower percentages of burned bone include 9, 10, 14(2), 14(3) and 15. Layer 10 has a moderate burned bone percentage (10%) and a moderate amount of identifiable bone (18%). This may suggest only moderate cultural modification and a greater influence from natural processes in affecting this bone assemblage. The other layers have very low percentages of burned bone (<2%) and natural weathering may be the more dominant sources of bone break-down in these layers. This pattern with somewhat higher percentages of identifiable bone in these layers may be explained by: 1) removal of smaller burned bone fragments by natural slope processes, 2) import of bison limbs for meat and marrow but not bone grease and/or 3) little cultural use of the bison killed at or near the site with removal of less dense elements by natural processes.

Cultural modifications of bone, such as cutmarks (surface cuts from meat removal), polish, cuts (through the bone) and impact butchering marks, are noted on bone from most layers (see Table 6.2). These modifications are absent in layers 14(1) and 15. Identification of these modifications is inhibited by considerable natural taphonomic factors, which primarily include weathering, carnivore chewing, rodent gnawing and root erosion. The number of cultural modifications as presented in Table 6.2 are, therefore, underrepresented. Table 6.3 provides the weights of culturally modified materials. This provides some indication of the prevalence of modification on certain sizes of remains. Natural modifications are discussed in Chapter 4 with the other information on site formation processes from soil and paleotopographic information.

Cutmarks and butchering indicators, such as impact scars, are the most common cultural modification recognized. Specific locations of cut marks and impact scars are noted in some of the following descriptions of the various identifiable fauna. The category, "impact scars", is used exclusively to denote impact or chipping from butchering activity. Very few bones indicate use modifications such as cut/whittled bone or polish. Their identifications are considerably inhibited by the fact that at least 3/4 of the bone displays moderate to extreme degrees of natural modification. Those bones considered potential tools or interesting bone modifications are discussed near the end of Chapter 5.

The presence or absence of cultural modifications is the important consideration, whereas the quantified values are limited in their comparative use. "Shovel trauma" indicates damage on bones from excavation, transport or

Table 6.2 Numbers of Cultural Modified Bone per Layer

Layer	Cutmarks	Polished	Cut	Multi Cul Alter	Other Cul Alter	Shovel Trauma
L 8(1)	0	0	0	0	9	5
L 8(2)	0	0	0	0	1	1
L 9	8	0	1	0	0	0
L 10	1	0	0	0	14	1
L 11	6	2	0	3	11	1
L 12	20	0	1	13	7	8
L 13(1)	7	0	0	1	4	2
L 13(2)	16	0	1	11	7	1
L 13(3)	1	0	0	0	1	0
L 13(4)	1	0	0	1	1	2
L 14(1)	0	0	0	0	0	2
L 14(2)	1	0	0	0	0	0
L 14(3)	0	0	0	0	1	0
L 15	0	0	0	0	0	0
TOTALS	44	2	3	29	56	23

Table 6.3 Weight (gm) of Cultural Modified Bone per Layer

Layer	Cutmarks	Polished	Cut	Multi Cul Alter	Other Cul Alter	Shovel Trauma
L 8(1)	0.0	0.0	0.0	0.0	556.2	422.3
L 8(2)	0.0	0.0	0.0	0.0	39.0	11.0
L 9	293.2	0.0	8.7	0.0	0.0	0.0
L 10	9.1	0.0	0.0	0.0	296.9	7.0
L 11	91.5	4.0	0.0	224.4	306.6	15.8
L 12	233.5	0.0	8.6	306.5	124.3	127.4
L 13(1)	109.9	0.0	0.0	54.9	390.4	163.5
L 13(2)	3.4	0.0	123.0	198.6	821.5	29.6
L 13(3)	11.2	0.0	0.0	0.0	27.3	0.0
L 13(4)	0.0	0.0	0.0	29.5	170.0	65.2
L 14(1)	0.0	0.0	0.0	0.0	0.0	17.1
L 14(2)	0.6	0.0	0.0	0.0	0.0	0.0
L 14(3)	0.0	0.0	0.0	0.0	119.2	0.0
L 15	0.0	0.0	0.0	0.0	0.0	0.0
TOTALS	752.4	4.0	140.3	813.9	2851.4	858.9

cleaning. The prevalence of this in a layer may reflect the more fragile nature of the bone due to the various post-depositional processes.

6.4) Identified Faunal Remains

An overview of the mammalian fauna represented in each layer can be gleaned from Table 6.4. This table presents the NISPs of the various mammal remains in each layer. Bison obviously predominate, but may be overemphasized by its comparatively large size and better preservation. Certainly other mammals represented were important parts of the ecosystem and/or cultural system of each group of occupants.

Table 6.4 NISPs of Mammals per Layer

Layer	Bison	Deer	Pronghorn	Canid	Mustelid	Lagomorph	Rodent
8(1)	46	1	1	0	0	21	2
8(2)	70	0	0	0	0	0	0
9	12	2	0	0	0	0	3
10	364	0	0	9	0	0	3
11	343	16	0	18	3	0	9
12	448	0	0	29	0	2	61
13(1)	106	0	0	1	0	0	18
13(2)	224	0	0	6	1	10	45
13(3)	12	0	0	2	0	0	4
13(4)	67	0	0	0	0	0	7
14(1)	8	1	0	0	0	0	16
14(2)	28	8	0	0	0	10	43
14(3)	13	0	0	0	0	0	22
15	12	0	0	2	0	0	0

Other animals represented in smaller numbers include aves, fish and amphibians. Avian NISPs are one for layer 8(1), seven for layer 13(1), and three for layer 13(4). Fish remains are represented by three specimens from layer 12 and three from layer 15. A single toador frog specimen is present in layer 9. Also, several toad or frog specimens are recovered from the flotation samples. These include one from layer 11, three from layer 12, and four from layer 13(2).

Some shell fragments and gastropods are present in layers 11 and 12. These materials are discussed further in chapter 7 with the flotation analysis.

The Minimum Number of Individuals (MNIs) for each animal grouping provides a different and somewhat better comparative approach than the NISPs. MNIs are discussed for each of the following animal groupings. By providing the number and kinds of element portions used to calculate MNIs, a better understanding is available for the certainty of the calculation, the potential for investigating animal parts utility, and the potential for the presence of more individuals. By keeping the discussion simple and straight-forward it is hoped to reduce the deleterious effects of the small sample size biases (Grayson 1981).

6.4.1) Family Bovidae. Genus *Bison*. *Bison bison*

Bison bison were the most common large artiodactyls in the plains region during all the occupations studied at the Redtail site. They make up the majority of the faunal assemblage in all occupations and reflect this dominance of the ecosystem. McDonald (1981) provides a discussion of the classification and evolution of North America's bison. Barsness (1985) reviews the historic demise of the great bison herds of North America and provides some good ethnographic accounts of their gregarious behavior. Arthur (1985) provides a seminal compilation of sources on bison.

The NISPs for several primary bison elements are provided for each layer in Table 6.5. These may provide a general indication of an element or part's presence but also reflects the degree of fragmentation of those parts. The small sample size for each assemblage and fragmentation of remains limits the use of this information, but it may be compared to the bison MNI for a general assessment of the contents of each assemblage.

The mature and immature bison remains are identified for each layer. Size and porosity of elements is compared to specimens of known ages in the

Table 6.5 NISPs of Bison Elements per Layer

Bison Part	Layers										
	8(1)	8(2)	9	10	11	12	13(1)	13(2)	13(3)	13(4)	14	15
Skull	0	0	0	42	5	36	0	44	0	0	38	0
Atlas Vert.	0	0	0	5	1	2	0	0	0	0	0	0
Axis Vert.	0	0	0	1	0	0	1	0	0	0	1	0
Cervical Vert.	1	0	0	0	2	6	0	2	0	0	1	0
Thoracic Vert.	0	0	1	8	28	60	2	20	2	1	7	0
Lumbar Vert.	1	0	0	0	1	13	1	4	0	0	3	0
Sacrum Vert.	0	0	0	0	0	3	0	0	0	0	0	0
Scapula	0	0	1	8	10	31	3	4	1	2	7	0
Humerus	1	1	0	0	3	48	5	23	1	3	4	0
Radius	2	1	0	5	5	5	10	15	0	1	5	2
Ulna	0	2	0	3	3	4	4	7	0	8	3	0
Radial Carpal	0	1	0	0	1	0	0	1	0	0	0	0
Ulnar Carpal	0	1	0	0	2	1	0	2	0	0	0	0
Internal Carpal	0	0	0	0	1	0	0	1	0	0	1	0
Unciform	0	0	0	0	1	0	0	1	0	0	0	0
Accessory	0	0	0	0	0	0	1	2	0	0	0	0
Fused 2&3 Carpal	1	0	0	0	2	1	0	1	0	0	0	0
Metacarpal	1	1	0	0	2	2	2	7	1	1	7	0
Femur	2	0	1	9	5	6	11	4	0	2	1	0
Patella	0	0	0	0	0	0	0	2	0	0	0	0
Tibia	6	0	7	1	3	18	4	11	3	0	2	2
Lateral Malleolus	1	0	1	0	0	1	1	2	0	0	0	1
Astragulus	2	0	0	0	2	2	2	1	0	1	1	0
Calcaneus	3	1	0	2	11	0	1	1	0	0	0	0
Fused 2&3 Tarsal	1	0	1	1	2	0	0	2	0	0	0	1
Fused C&4 Tarsal	7	0	1	0	2	1	0	1	0	0	0	0
Metatarsal	5	0	1	2	8	2	4	0	0	0	4	0
1st Phalanx	4	12	0	0	8	2	8	4	0	0	1	0
2nd Phalanx	4	2	1	0	8	6	0	8	1	0	0	0
3rd Phalanx	3	1	0	0	3	6	4	4	0	0	3	0
Superior Sesmoid	2	0	0	15	6	4	25	3	24	0	0	0
Inferior Sesmoid	0	0	0	0	0	2	0	0	0	0	0	0

faunal collection at the University of Saskatchewan's Department of Anthropology and Archaeology laboratory. This provides age estimates for some of the specimens under one year old. Some of these are further used for seasonality estimates. However, it must be stressed that these are tentative at best due to the overall small sample size and the sizing approach used to age specimens.

Table 6.6 notes the most complete and nearly complete mature bison elements or element portions in each layer. It also presents each layer's resultant MNI for mature bison specimens. Not all complete elements are noted in this table, so this cannot be used for overall comparisons of bison portion representation. For example, phalanges and sesmoids are not presented because they are less useful for MNI determinations. These other elements are present but not plentiful enough to increase MNI in any layer (see Table 6.5 for NISPs).

The majority of layers exhibit an MNI of one mature bison per layer. Exceptions to this include layers 10, 13(1) and 13(2) which have MNIs of two for each layer. Layer 11 and 13(2) have the greatest number of specimens supporting their MNI determinations (see Table 6.6). This may reflect more complete bison skeletons at the site. Layers 10, 12 and 13(1) also have moderate numbers of specimens to support the validity of their MNI determination. However, specimens from layers 10 and 11 may represent portions of two individuals and layers 13(1) and 13(2) may represent portions of two individuals as these two sets of layers have close stratigraphic proximity to each other and greater potential for mixing. Layers 8(1) and 8(2) have lower numbers of specimens, and layers 9, 13(3), 13(4), 14(1), 14(2) and 14(3) had only a few specimens to determine their MNI. These latter occupations may thus have greater potential for importation of bison from outside the site or excavation area, such as layer 8(2) represented by right forelimb bones, layer 9 represented by right hindlimb bones and layer

Table 6.6 Mature Bison MNI per Layer

Elements/ Portions	Layer 8(1)	Layer 8(2)	Layer 9	Layer 10	Layer 11	Layer 12	Layer 13(1)	Layer 13(2)	Layer 13(3)	Layer 13(4)	Layer 14(1)	Layer 14(2)	Layer 14(3)	Layer 15
Atlas	0	0	0	2	1	0	0	0	0	0	0	0	0	0
Axis	0	0	0	1	0	0	1	0	0	0	0	1	0	0
Horn Core/L	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Horn Core/R	0	0	0	1	1	0	0	1	0	0	0	0	0	0
Nasal/L	0	0	0	2	0	0	0	0	0	0	0	0	0	0
Nasal/R	0	0	0	2	0	0	0	0	0	0	0	0	0	0
Premax/L	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Premax/R	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Petrous/L	0	0	0	1	1	0	0	0	0	0	0	0	1	0
Petrous/R	0	0	0	1	1	1	0	0	0	0	0	0	0	0
Mand.cond/L	0	0	0	0	1	0	0	1	0	0	0	0	0	0
Mand.cond/R	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Mand.coro/L	0	0	0	0	0	0	0	2	0	0	0	0	0	0
Mand.coro/R	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Mand.symp/L	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Mand.symp/R	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Lower.M3/L	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Lower.M3/R	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Acetabulum/L	1	0	0	0	0	0	0	1	0	0	0	0	0	0
Acetabulum/R	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Prx.Scapula/L	0	0	0	0	0	0	2	0	0	1	0	0	0	0
Prx.Scapula/R	0	0	0	1	0	0	0	0	1	0	0	0	1	0
Prx.Humerus/L	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Prx.Humerus/R	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Dis.Humerus/L	0	0	0	0	0	1	0	1	0	0	0	0	0	0
Dis.Humerus/R	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Prx.Radius/L	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Prx.Radius/R	0	1	0	0	0	0	1	1	0	0	0	0	0	0
Dis.Radius/L	1	0	0	0	1	0	1	0	0	0	0	0	0	0
Dis.Radius/R	0	1	0	0	0	1	0	0	0	0	0	0	0	0
Prx.Ulna/L	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Prx.Ulna/R	0	1	0	0	0	1	0	1	0	0	0	0	0	0
Prx.Metcarp/L	0	0	0	0	1	1	0	0	0	0	0	0	0	0
Prx.Metcarp/R	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Dis.Metcarp/L	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Dis.Metcarp/R	1	1	0	0	0	1	1	1	1	0	0	0	0	0
Carpal,Uln/L	0	0	0	0	1	0	0	1	0	0	0	0	0	0
Carpal,Uln/R	0	1	0	0	0	1	0	1	0	0	0	0	0	0
Carpal,Int/L	0	0	0	0	1	0	0	0	0	0	1	0	0	0
Carpal,Int/R	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Carpal,Rad/L	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Carpal,Rad/R	0	1	0	0	0	0	0	1	0	0	0	0	0	0
Carpal,Acc/L	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Carpal,Acc/R	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Carpal,2/3/L	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Carpal,2/3/R	1	0	0	0	1	1	0	1	0	0	0	0	0	0

Table 6.6 Mature Bison MNI per Layer (Continued)

Elements/ Portions	Layer 8(1)	Layer 8(2)	Layer 9	Layer 10	Layer 11	Layer 12	Layer 13(1)	Layer 13(2)	Layer 13(3)	Layer 13(4)	Layer 14(1)	Layer 14(2)	Layer 14(3)	Layer 15
Carpal, 4/L	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Carpal, 4/R	0	0	0	0	0	0	0	1	0	0	0	0	0	0
MCarpal, 5/L	0	0	0	0	0	1	1	0	0	0	0	0	0	0
MCarpal, 5/R	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Prx.Femur/L	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Prx.Femur/R	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Dis.Femur/L	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dis.Femur/R	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Prx.Tibia/L	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Prx.Tibia/R	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dis.Tibia/L	1	0	0	0	1	0	0	1	0	0	0	0	1	0
Dis.Tibia/R	0	0	1	0	0	0	1	0	0	0	0	0	0	0
Prx.Metars/L	0	0	0	0	0	0	2	0	0	0	0	0	0	0
Prx.Metars/R	0	0	1	1	1	0	0	0	0	0	0	0	0	0
Dis.Metars/L	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Dis.Metars/R	1	0	0	1	1	1	0	0	0	0	0	0	0	0
Astragalus/L	1	0	0	0	1	1	0	1	0	1	0	0	1	0
Astragalus/R	0	0	0	0	1	1	2	0	0	0	0	0	0	0
Calcaneus/L	0	0	0	2	0	0	0	1	0	0	0	0	0	0
Calcaneus/R	1	1	0	0	1	1	0	0	0	0	0	0	0	0
Tarsal2&3/L	0	0	0	1	0	0	0	1	0	0	0	0	0	0
Tarsal2&3/R	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Tars.Cen4/L	1	0	0	0	1	0	0	1	0	0	0	0	0	0
Tars.Cen4/R	0	0	1	0	1	1	0	0	0	0	0	0	0	0
Tarsal,1/L	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tarsal,1/R	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Lat.Malleo/L	0	0	0	0	0	0	0	2	0	0	0	0	0	0
Lat.Malleo/R	0	0	1	0	0	0	1	0	0	0	0	0	0	0
Patella/L	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Patella/R	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Layers MNI =	1	1	1	2	1	1	2	2	1	1	1	1	1	1
Total specimens Used for MNI	9	8	5	16	28	14	17	28	2	3	2	2	4	0

13(3) represented by right forelimb bones. Layer 8(1) and layer 14 sublayers contain varying portions of some axial elements which suggest that they were probably not imported from outside the site area.

Immature bison MNI are present in layers 8(1), 8(2), 11, 12, 13(1), 13(2), 13(3), 13(4) and 14(2) as indicated in Table 6.7. Age estimates are provided for specimens when possible. In layer 8(1) there appears to be a younger bison individual represented by a set of five left tarsals. These are similar in size and porosity to a one-month old specimen in the University of Saskatchewan, Department of Anthropology and Archaeology's faunal collection specimen #M06-03-07. This suggests that this bison calf would have died in the spring to mid-summer, assuming peak calving about April 15 to May 15. Another, older, individual is represented by immature medial portions of a left radius and a metatarsal of indeterminate side. Comparisons with laboratory specimens #M06-03-10 and #M06-03-08 suggests that this individual is about 7 months old, in which case it died in the fall or early winter.

Layer 8(2) may also have two immature bison present. However, there may be an overlap of one specimen 1 to 2 months old which is represented only by a left horizontal ramus portion of a mandible. This specimen was located in unit 123N, 108E in which layers 8(1) and 8(2) coalesced. Thus, this specimen may be the same individual as represented by the approximated one-month old tarsal bones in layer 8(1). Although we made an effort to excavate these layers separately, this could not always be done, and the sublayers are so close together in places that there is a good chance that natural processes could have mixed their contents. This one-to two-month old specimen is, therefore, probably associated with layer 8(1). Another younger specimen is represented in layer 8(2) in a location where the layers are better separated. It is a mid-portion of a left humerus. This specimen is smaller and more porous than a one week old

Table 6.7 Immature Bison MNI per Layer

Elements/ Portions	Layer 8(1)	Layer 8(2)	Layer 9	Layer 10	Layer 11	Layer 12	Layer 13(1)	Layer 13(2)	Layer 13(3)	Layer 13(4)	Layer 14(1)	Layer 14(2)	Layer 14(3)	Layer 15
Cervical,N.Cmplt	0	0	0	0	0	1,7m	0	0	0	0	0	0	0	0
Zygomatic.Frg/L	0	0	0	0	1,?	0	0	0	0	0	0	0	0	0
Zygomatic.Frg/R	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mand.cond/L	0	0	0	0	0	0	0	1,?	0	0	0	1,3w	0	0
Mand.cond/R	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mand.hor.ram/L	0	1,1-2m	0	0	0	1,?	1,2-3m	1,?	0	0	0	0	0	0
Mand.hor.ram/R	0	0	0	0	1,1y	0	1,2-3m	0	0	0	0	0	0	0
Mand.coro/L	0	0	0	0	0	0	0	1,?	0	0	0	1,3w	0	0
Mand.coro/R	0	0	0	0	0	0	0	0	0	0	0	0	0	0
L.Descid.P4/L	0	0	0	0	0	0	0	0	0	0	0	0	0	0
L.Descid.P4/R	0	0	0	0	1,1y	0	0	0	0	0	0	0	0	0
Incisor/L	0	0	0	0	0	1,?	0	1,?	0	1,?	0	0	0	0
Incisor/R	0	0	0	0	0	1,?	0	0	0	0	0	0	0	0
Humer/Mid/L	0	1,<1w	0	0	0	0	0	0	0	1,1m	0	0	0	0
Humer/Mid/R	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Radius/Mid/L	1,7m	0	0	0	0	0	0	0	0	0	0	0	0	0
Radius/Mid/R	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dis.RadiusFrg/L	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dis.RadiusFrg/R	0	0	0	0	0	0	0	0	0	0	0	1,?	0	0
Prx.Ulna/L	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Prx.Ulna/R	0	0	0	0	0	1,7m	0	0	0	0	0	0	0	0
Prx.Metcarp/L	0	0	0	0	0	1,?	0	0	0	0	0	0	0	0
Prx.Metcarp/R	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Med.MetaC.Frg/?	0	0	0	0	0	0	0	0	0	0	0	1,?	0	0
Med.Femur/L	0	0	0	0	1,1y	0	0	0	0	0	0	0	0	0
Med.Femur/R	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tibial Frag/L	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tibial Frag/R	0	0	0	0	0	0	0	0	1,?	0	0	0	0	0
Metars/Mid/In	1,7m	0	0	0	0	0	0	0	0	0	0	0	0	0
Astragalus/L	1,1m	0	0	0	0	0	0	0	0	0	0	0	0	0
Astragalus/R	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Calcaneus/L	1,1m	0	0	0	0	0	0	0	0	0	0	0	0	0
Calcaneus/R	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tarsal2&3/L	1,1m	0	0	0	0	0	0	0	0	0	0	0	0	0
Tarsal2&3/R	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tars.Cen4/L	1,1m	0	0	0	0	0	0	0	0	0	0	0	0	0
Tars.Cen4/R	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tarsal,1/L	1,1m	0	0	0	0	0	0	0	0	0	0	0	0	0
Tarsal,1/R	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pelv,Isch.Frg/L	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pelv,Isch.Frg/R	0	0	0	0	1,?	0	0	0	0	0	0	0	0	0
1st Phalanx,all	1,?	0	0	0	0	0	0	1,?	0	0	0	0	0	0
2nd Phalanx,all	1,1m	0	0	0	0	1,?	0	0	0	0	0	0	0	0
3rd Phalanx,all	1,1m	0	0	0	0	1,7m	0	0	0	0	0	0	0	0
Layer's MNI	1,1m	1,<1w	0	0	1,1y	1,7m	1,2-3m	1,?	1,?	1,1m	0	1,3w	0	0
and mean ages	1,7m	1,1-2m												

Each bone part is followed by an age estimate if available, e.g. 1m= 1month, 1w= 1week & 1y= 1year.

specimen in the laboratory, #M06-03-05. Such a young individual suggests a spring death, sometime from March to May.

Layer 11 has five immature bison specimens that probably represent one individual. A right horizontal ramus and mid-portion of a left femur both suggest an age of about 1 year old based on Brumley's (1990) tooth eruption and wear stages (TEWS) and comparison with two known one year old specimens, #M06-03-09 and #M06-03-11. This suggests a timespan encompassing spring and early summer as the possible season of death for this bison.

Layer 12 has eight immature bison specimens which also likely represent one individual. Three of these specimens, which include a proximal right ulna, are similar in size to lab specimen #M06-03-10, which is a 7 month old male, and are larger than specimen #06-03-08 (6 to 7 months old). This age suggests that the bison died in the fall or winter. Some specimens of unknown age in both layers 11 and 12 may be from the same individual, due to the closeness of these layers. However, this does not seem likely as the 1 year and 7 month old sized specimens are consistently represented in layers 11 and 12 respectively.

Layer 13(1) has two matching portions of immature bison horizontal ramii. Based on comparisons with known age specimens #M06-03-06 (3 weeks), #M06-03-07 (1 month), #M06-03-08 (6 to 7 months), #M06-03-10 (7 month, male) and Frison and Reher's (1970: 46-48) aging categories, this individual was probably 2 to 3 months old at the time of its death.

Five immature bison specimens from layer 13(2) could not be adequately aged with comparative specimens or other available sources. However, they do indicate that at least one immature bison individual is present in this layer in addition to the two mature bison individuals.

Only one immature bison specimen is present in layer 13(3), and represents one individual. No age estimate was obtainable from the right tibial fragment represented. Layer 13(4) has two specimens representing immature bison. One of these, a mid portion of a left humerus, is similar in size and porosity to a one month old laboratory specimen #M06-03-07. This may indicate a spring or summer time of death for this bison.

Layer 14(1) has no immature bison material associated with it. However, layer 14(2) has four such specimens. Two left mandibular portions are similar in size, porosity and eruption to laboratory specimen #M06-03-06 which is three weeks old. This suggests a spring/ early summer season for this animal's death. Neither of layers 14(3) nor 15 contain any immature bison remains.

6.4.2) Family Cervidae. Genus *Odocoileus* - Deer.

There are a few cervids represented in these layers. These include a general grouping of deer (*Odocoileus sp.*) (Table 6.8). Identifications are based on comparisons with white-tailed deer laboratory specimens #M06-01-02, #M06-01-03, #M06-01-04 (male), #M06-01-11, and mule deer specimens #M06-01-05 (male) and #M06-01-06. Bird (1961) reviews some observations during the late 1800s and early 1900s of white-tailed deer replacing the mule deer that had previously dominated the Parklands. This historic evidence suggests that white-tailed deer only became common to this area during recent contact times, when the demise of the bison's dominance of the Plains and the depletion of elk opened a niche. Thus, deer identified may represent predominantly mule deer, although several specimens are smaller and similar in size to the white-tailed deer comparative specimens.

Layer 8(1) has a single mature deer MNI represented by one specimen. This specimen is a left distal humerus. The mid-shaft of the humerus has a spiral fracture with canid tooth punctures adjacent to the fracture both above and below. The softer distal end is considerably canid-gnawed as well. Another immature deer MNI is represented by two specimens in layer 9.

Table 6.8 MNI for Other Larger/Mid-sized Mammals and Aves

Layer	Deer	Pronghorn	*Canis sp.*	Red fox	Jackrabbit	Snowshoe Hare	Mustelid	Bird
8(1)	1M	1M	0	0	1M	0	0	1 Corvidae (Crow)
8(2)	0	0	0	0	0	0	0	1 Falconiformes (Hawk)
9	1im	0	0	0	0	0	0	0
10	0	0	1M	1M	0	0	0	0
11	1im	0	1-2M?	0	0	0	1im,Skunk	0
12	0	0	1M,1im	1M	1M	0	0	0
13(1)	0	0	1im	0	0	0	0	1 Passeriformes (Robin)
13(2)	0	0	1?	0	1M	1M	1M,Mink	0
13(3)	0	0	1M	0	0	0	0	0
13(4)	0	0	0	0	0	0	0	1 Corvidae & 1 Mallard
14(1)	1M	0	0	0	0	0	0	0
14(2)	1M	0	0	0	1M	0	0	0
14(3)	0	0	0	0	0	0	0	0
15	0	0	2M	0	0	0	0	0

Note: M= Mature Individuals, im= Immature Individuals and ? indicates indeterminate.

Sixteen specimens represent at least one immature deer in layer 11. A metapodial mid-section has canid tooth scouring marks on both ends, and the periosteal bone growth on the outside surface is extensively root etched. This, or another immature individual, also has unfused phalanges suggesting an age less than 11 or 12 months (Gilbert 1980a: 100-103). A mature deer MNI is represented by one specimen in layer 14(1). Layer 14(2) has 8 specimens which represent at least one mature deer.

6.4.3) Family Antilocapridae. Genus *Antilocapra*.

***Antilocapra americana* - Pronghorn.**

There is only one specimen that may belong to this species. Layer 8(1) yielded a mature second phalanx which only fits this small ungulate species (see Table 6.8). Several comparisons were made with two known pronghorn specimens #M06-02-01 (female) and #M06-02-02 (female), and with several smaller white-tailed deer specimens #M06-01-02, #M06-01-03 and #M06-01-11.

The recent historic distribution of pronghorn covers the southern Plains areas of Saskatchewan (see Banfield 1987: 402-404). Modern pronghorns are known to wander northward into the parkland in the summers, at least as far as the Cut Knife area near Battleford. They prefer areas with less snow in the winters for feeding, such as the shortgrass prairies in southwestern Saskatchewan. They are also known to "mix amicably with bands of cattle, sheep, and mule deer" (Banfield 1987: 402). It is not surprising to have pronghorn remains found this far north especially when paleoclimatic differences are considered.

6.4.4) Order Carnivora. Family Canidae. Genus *Canis* and *Vulpes*.

There are at least eleven individuals representing this category (Table 6.8). Comparative identifications are based on similarities to known coyote laboratory specimens #M02-03-03, #M06-03-05, #M06-03-06 and #M06-03-09 to 15, and wolf comparative specimens #M02-03-03, #M02-03-04 (male) and #M02-03-29. Red fox are identified with comparison to specimens #M02-03-07 (male), #M02-03-08, #M02-03-19 to 28 and #M02-03-31 (immature). No domestic canid specimens of any sort were available for comparison.

A single *Vulpes vulpes* or red fox is present in layer 10. It is represented by an upper second right molar. One of the *Canis sp.* individuals is also in layer 10. This animal is represented by a nearly complete right ulna and radius. Both bones are broken near their distal ends in a squared transverse line at the same location of the articulated limb. Thus, such breaks indicate that these bones were articulated when the breaks occurred, and the straight break also suggests that these bones were not fresh when broken (see Johnson 1985: 180-184). Three tooth scouring marks near the broken end of the radius indicate rodent gnawing or carnivore gnawing. The bone is weathered and root-etched, so the details are difficult to discern. Two of the gnaw grooves appear to have multiple furrows within them which reflect rodent incisors as opposed to carnivore carnassials. A right proximal scapula is also present and may be from this same canid individual. It, too, is weathered and root-etched.

Layer 11 may have two possible *Canis sp.* individuals represented. These canids are represented by burned phalanx fragments, left and right ulna portions, two carpals and two distal right humeri which are all intermediate sizes between wolf and coyote. Some of these are only slightly larger than the coyote specimens while others seem more robust and wolf-like.

The two right humeri portions indicate two *Canis sp.* with a more wolf-like robustness. One of these right humeri is nearly complete; however, the distal end is heavily gnawed and the proximal end has obvious opposing carnassial punctures (Figure 4.17). The other right distal humerus portion is deprived of its distal articular end and has a straight possibly "dry" break. There are several small cut marks concentrated both on the anterio-medial ridge and anterio-lateral side of the distal shaft. They run across the shaft only 2 to 3 mm long in the medial cluster, and 4 to 6 mm long in the lateral cluster (Figure 6.1). These suggest cutting activity to sever tendons in order to disarticulate the limb. This humerus is broken in a spiral fracture toward its midsection. Some polishing is noticeable along this broken edge but this may be due to natural processes.

Both the wolf-sized right proximal radius and right proximal ulna are moderately weathered and coated in calcium carbonate on their bottom surface. The two wolf-sized proximal portions of right second and third metatarsals are rounded from weathering, and the first of these has some polish on its spiral break and adjacent surface. This polish may be due to weathering. A complete ulnar carpal and fourth carpal are *Canis sp.*, but are also rounded by weathering. A second phalanx portion is scorched on the proximal anterior edge and is slightly larger than available coyote specimens. Two other indeterminate metacarpal fragments are slightly smaller than the coyote comparative specimens and are completely calcined. These latter fragments may indicate another individual, possibly an immature canid or coyote-sized canid.

Layer 12 has several specimens that represent at least three individuals. Two of these are wolf-sized canids, one mature and one immature. The mature *Canis sp.* is represented by an upper right canine and second molar, a lower left canine, and a lower right fourth premolar. There is also a weathered and apparently purposefully rounded canid metapodial which may also belong to this individual (see Figure 5.13). The immature wolf-sized canid is represented by tooth caps of an upper left third deciduous premolar and first permanent molar. A mature red fox is represented in layer 12 by an upper left second premolar, third premolar and first molar. Another lower right first permanent molar from an immature *Canis sp.* is also in this layer. However, it matches the

Figure 6.1 Cutmarks across distal end of canid humerus

size and wear of a left mandibular portion from layer 13(2) in the same unit, 123N 108E. It appears that this tooth is displaced by rodent disturbance and actually fits with the layer 13(2) immature individual.

There is only one fragmented occlusal surface of a molar from a *Canis sp.* in layer 13(1). It is in unit 123N 108E and may actually fit with the immature *Canis sp.* in layer 13(2). Again, it is assumed that the same disturbance as above, and closeness of the layers, has influenced the positioning of these remains in this unit.

Layer 13(2) has a minimum of one immature *Canis sp.* individual represented by a left portion of a horizontal ramus found in unit 123N 108E. This specimen has a canine and a first permanent molar which matches the left counterpart in layer 12. A tooth fragment from layer 13(1) may also be part of this individual. Another cluster of *Canis sp.* bones is farther downslope in unit 122 N 113E and 123 N 113E. These include a nearly complete matching left radius and ulna. Both specimens are weathered and have dry bone breaks. Also, there is a weathered, complete distal phalanx which is *Canis sp*. This other cluster of bones may be another individual, or may be the same immature individual as the above mandible.

Layer 13(3) has two burned right tarsals, a third and fourth, which represent a mature coyote-sized canid. Both have also been rounded by weathering. None of the layer 14 sublayers have any canid remains. Layer 15(1) has a nearly complete upper third molar that is coyote-sized. In layer 15(3) a nearly complete right external auditory meatus is wolf-sized.

6.4.5) Order Carnivora. Family Mustelidae.

Mephitis mephitis **- striped skunk and** ***Mustela vison*** **- mink.**

There are only two mustelids identified (Table 6.8). In layer 11 there is one immature striped skunk (*Mephitis mephitis*) represented by two right maxillary portions. These are comparable to lab specimen #M02-04-07. This maxilla includes three incisors, a canine, a complete second molar and partial portions of the second premolar and first molar.

In layer 13(2) is a nearly complete lower left canine with the root broken off. It was compared with many specimens and matches mink best (e.g. specimens #M02-04-17, male, and #M02-04-19, male) because of its greater curvature and robusticity. Thus, it has been identified as probably representing mink (*Mustela vison*).

6.4.6) Order Lagomorpha. Family Leporidae.

Lepus **- Rabbits and Hares.**

There are 43 specimens representing at least five individuals (see Tables 6.4 and 6.8). Four of these are jackrabbit (*Lepus townsendii*) and one individual is a snowshoe hare (*Lepus americanus*). Both species are common to this area.

Layer 8(1) has a nearly complete portion of a right ischium and a lumbar vertebra, probably from a larger jackrabbit. Some tooth fragments and long bone fragments of a lagomorph are also from this layer, and are likely from the same or a similarly-sized individual. Layers 8(2), 9, 10, and 11 contain no lagomorph remains.

Layer 12 contains a weathered right distal humerus of a jackrabbit. This represents one individual for this layer. Layer 13(1) contains no lagomorph remains.

Layer 13(2) has a minimum of two individuals represented, one jackrabbit and one snowshoe hare. The jackrabbit is represented by a distal right humerus and a right patella. Two burned and fragmented right metacarpals may also go with this individual but they were 3 metres away from the humerus and patella. The snowshoe hare is represented by another distal right humerus, in the same unit as the jackrabbit humerus.

There are no lagomorphs in layers 13(3), 13(4) or 14(1). In layer 14(2), however, there is one jackrabbit represented by several pieces. These include a distal right humerus, a proximal right radius, three metacarpal portions, two other long bone fragments, a carpal, a proximal and a distal phalanx.

6.4.7) Order Rodentia - Rodents.

The faunal analysis program differentiated rodent and micro-rodent categories (see Gibson 1991; McKeand and Gibson 1992). The rodent category includes the larger rodents from beaver and porcupine through ground squirrels and pocket gophers. Microrodents, on the other hand, include voles, mice and shrews. Note that the specimens in these categories are recovered from careful excavation procedures. The fine-screen samples have yet to be studied. Thus, there may be differential representation of larger elements over smaller ones and larger rodents over smaller ones in this sample. Analysis of the fine-screen data should correct some of these biases.

An MNI is presented in Table 6.9 for both rodents and micro-rodents per layer. These calculations are based primarily on 34 complete to nearly complete mandibles, about 13.5 maxillae sets of varying preservation, and some counts on non-cranial elements. Identifications are primarily based on Chomko (1980: 72-99) and some comparisons with a few available laboratory comparative specimens. Some individuals were identified using both maxilla and mandibles, while others were identified with as little as a few teeth in a maxilla or mandible. Only the most distinctive dentition could be identified by the latter approach (e.g. *E. minimus* or *Z. princeps*). Some voles, on the other hand, could only be identified to the subfamily Microtinae or *Microtus sp.* when a complete dentition was not available or was in too poor a condition.

The larger rodent category has 12 individuals represented throughout. Five of these are in layers 9 through 12 inclusive. In each of these layers a single

Table 6.9 MNI for Identified Rodents and Micro-rodents

	LAYERS													
IDENTIFICATIONS	8(1)	8(2)	9	10	11	12	13(1)	13(2)	13(3)	13(4)	14(1)	14(2)	14(3)	15
RODENTS:														
S. richardsoni	0	0	1	1	1	1	0	0	1	0	2	0	0	0
S. tridecemlineatus	0	0	0	0	1	0	0	0	0	0	0	0	0	0
T. talpoides	0	0	0	0	0	0	0	1	0	0	1	0	1	0
Indeterminate	0	0	0	0	0	0	0	0	0	0	0	1	0	0
TOTAL/Layer	0	0	1	1	2	1	0	1	1	0	3	1	1	0
MICRO-RODENTS:														
C. gapperi	0	0	0	1	0	0	0	1	0	1	0	3	1	0
E. minimus	0	0	0	0	1	1	1	0	1	0	0	0	0	0
M. pennsylvanicus	0	0	0	0	0	0	0	0	0	0	1	0	0	0
M. ochrogaster	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Microtus sp.	0	0	0	0	0	1	0	0	0	0	0	1	0	0
P. maniculatus *	0	0	0	0	0	2	0	0	0	1	0	0	0	0
R. megalotis	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Z. princeps	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Indeterminate	1	0	1	0	0	0	1	0	0	0	0	0	0	0
TOTAL/Layer	1	0	1	1	1	5	2	1	1	3	1	5	1	0

individual is identified as Richardson's ground squirrel (*Spermophilis richardsoni*). In layer 11 a second individual is identified as a thirteen-lined ground squirrel (*Spermophilis tridecemlineatus*).

Layer 13(2) has a single individual identified as a northern pocket gopher (*Thomomys talpoides*). In layer 13(3) another individual is identified as *S. richardsoni*.

Three individuals are in layer 14(1). These include two *S. richardsoni* and a *T. talpoides*. Layer 14(2) has an indeterminate individual represented and layer 14(3) has another *T. talpoides* individual.

There is more variety of the micro-rodents and 23 individuals are identified throughout the layers. Layers 8(1) and 9 both have remains of indeterminate micro-rodent individuals. Layer 10 has a single Gapper's red-backed vole (*Clethrionomys gapperi*) represented. Layer 11 is represented by a MNI of a one least chipmunk (*Eutamius minimus*).

Layer 12 has five MNI represented. These include a single *E. minimus*, two deer mice (*Peromyscus maniculatus*), a western harvest mouse (*Reithrodontomys megalotis*) and a vole (*Microtus sp.*). Layer 13(1) contains an indeterminate micro-rodent and a *E. minimus* individual. A single *C. gapperi* is present in layer 13(2). An *E. minimus* is in layer 13(3). Three individuals in layer 13(4) include a *C. gapperi*, Prairie vole (*Microtus ochrogaster*), and a *P. maniculatus*. Layer 14(1) has a single meadow vole (*Microtus pennsylvanicus*). Three genera are contained in layer 14(2). These include three *C. gapperi*, a single western jumping mouse (*Zapus princeps*) and a *Microtus sp.* Layer 14(3) has a single *C. gapperi* represented.

It may be noted that the two *C. gapperi*, *Z. princeps* and *Microtus sp.* individuals in layer 14(2) are all represented by paired mandibles and found in a cluster which includes several broken rodent limb, pelvis and other bones. These were probably deposited at the site as an owl pellet or a canid scat/disgorge. Several of the rodent remains could have been deposited in this manner, but this latter situation seems the most obvious. Some specimens are nearly complete and well preserved. This may suggest death within a burrow and a more recent age than the excavation layer indicates. Morlan (1992b: 9) suggests examining the extremities, such as the phalanges and incisors, for scorching which can reflect cooking whole rodents over a fire or in coals. No recovered specimens indicate such scorching. This does not rule out the possibility of rodent subsistence since not many phalanges are recovered in this coarse-screen rodent sample. The fine-screen data should include more phalanges and could provide a better assessment of rodent subsistence possibilities.

6.4.8) Class Aves - Birds

In layer 8 there are two birds identified (Table 6.8). A left proximal portion of a carpo-metacarpus is identified with the Corvidae family. It most closely resembles the size and shape of the common crow. However, this more specific identification is tentative. A talon also found in this layer is identified with the Falconiformes family. Its size matches lab specimens of red-tailed hawk (*Buteo jamaicensis*) but it may also be another similarly sized common hawk, such as the Swainson's hawk (*Buteo swainsoni*) or others.

Layer 13(1) has several specimens identified with a Passeriformes bird (Table 6.8). These include a complete left femur, a right coracoid, a right distal humerus, a left humerus midshaft, a right carpo-metacarpus, a right ulna and fragments of a right radius. These remains closely match those of the robin (*Turdus migratorius*).

Layer 13(4) includes birds specimens that represent two MNI (Table 6.8). A left proximal humerus and left proximal ulna are identified as Corvidae. They both closely resemble the crow (*Corvus brachyrhynchos*) comparative specimens.

Another bird is represented by a fairly diagnostic portion of the sternum which articulates with the cervical vertebrae (the cranial process of the manubrium). It, and a left distal coracoid, are identified to the Sub-family Anatinae and are identical to the mallard (*Anas platyrhynchos*). Both of these birds are known to inhabit the area during the summer, including late spring and early fall.

6.4.9) Other Animals

This category includes a few amphibian, fish, mollusk and gastropod remains. The NISPs and identifications are presented for these animals in Table 6.10. Most of these remains recovered came from the flotation analysis. Therefore, it is expected that analysis of the fine-screen data will significantly contribute to this category of fauna. The toad/frog category includes a right half of a urostyle from layer 9. It closely resembles the size and shape of the Canadian toad (*Bufo boreas*) specimen in the comparative collection. This identification is probably correct considering the few possible alternative species available (see Hilderman *et al.* 1986: III-12). Other fragments of toad or frog are from feature's flotation samples in layers 11, 12 and 13. They are generally smaller specimens and may be *Rana sp.* or *Pseudacris sp.* but they are indeterminate because no comparative specimens are available. They are described in Chapter 7 with the other flotation analysis data that also includes mollusk shell and gastropod specimens.

The layer 12 probable fish remains seem to represent paired toothed fragments. There are no laboratory specimens to compare with the archaeological specimens. Fish remains are present in layer 15. Two nearly complete vertebrae indicate at least two individuals are represented. One vertebra is larger, 11.3 mm to 12.5 mm around by about 9.4 mm thick, and hexagonal in shape. Another fish vertebra is smaller, 6.4 mm and 7.2 mm reflecting its oval shape, and about 3.9 mm thick. Another specimen from a larger fish is represented by a

Table 6.10 NISPs and Identifications of Other Animals

Identifications	Toad/Frog	Fish	Mollusk shell	Gastropod
8(1)	0	0	0	0
8(2)	0	0	0	0
9	1c	0	0	0
10	0	0	0	0
11	1f	0	0	0
12	3f	3f	3f	6c,1f
13(1)	0	0	0	0
13(2)	4f	0	0	0
13(3)	0	0	0	0
13(4)	0	0	0	0
14(1)	0	0	0	0
14(2)	0	0	0	0
14(3)	0	0	0	0
15	0	3f	0	0

Note: f= fragments, c= complete elements/structures

proximal portion of a brachiostegal ray (see Cannon 1987: 19 and 60). This has been identified by Morlan (personal communication, 1992) as a brachiostegal ray from a catfish. This fish may also be represented by the larger vertebrae above. Thus, a catfish and smaller fish constitute an MNI of two for layer 15.

6.5) Bone Measurements and Bison Gender Analysis

There are only a few bones complete enough to obtain measurements. Most of these are bison. A nearly complete bison skull from layer 10 produced some valuable measurements to compare with other skulls. Measurements on bison long bones use Speth's definitions (1983: 172-180), and subsequent gender determinations follow Walde's (1985) method. Walde (personal communication October 3, 1992) has warned that his proximal metapodial equations do not necessarily separate gender, but may separate older bulls from the young bulls and cows. He also indicated that carpal and tarsal measurements are somewhat more controversial for gender determinations. However, measurements presented are based on Morlan (1991) so that these data can be available to other researchers. Some other measurable bison specimens include atlas, acetabulum and glenoid fossae of the scapula. These measurements are based on von den Driesch's definitions (1976: 67-83). Also, a single canid humerus is complete enough to obtain some measurements which are also taken from von den Driesch (1976: 76-77). A few canid teeth are measured based on von den Driesch (1976: 42-45 and 60-61) and note is taken of Olsen's (1985) 13 essential measurements for multivariate determinations of wild vs. domesticated canids.

6.5.1) Bison Longbone Gender Determinations

Longbone measurements and associated gender calculations are presented in Appendix A, Tables 1 to 12. These include measurements on 7 distal metatarsals, 4 proximal metatarsals, 4 distal metacarpals, 2 proximal metacarpals, 3 distal tibii and 5 proximal radii. A synthesis of the gender determinations from these 25 specimens is provided in Table 6.11.

In layer 8(1) the gender of a distal metacarpal is indeterminate, while a distal metatarsal is a definite female. These likely represent one female individual. A complete metacarpal in layer 8(2) (specimen #441) is a definite male. Also, in this layer, both a distal metatarsal and proximal radius determination strongly indicate a female. This may represent other elements from the same female individual seen in layer 8(1). Layer 9 has a definite male distal tibia and a proximal metatarsal of indeterminate gender. These may represent a single male bison. Both the proximal and distal ends of a metatarsal (specimen #4294) found in layer 10 are from a definite male. In layer 10 there is an MNI of two and one of these is a male. Layer 11 has three specimens which resulted in an indeterminate and two strong female determinations. With an

Table 6.11 Bison Specimen Gender Determinations/Layer

Layer	Male spec.	Indeterminate spec.	Female spec.	MNI from Table 6.6
8(1)	0	1	1	1
8(2)	1*	0	2	1
9	1	1	0	1
10	1*	0	0	2
11	0	1	2	2
12	0	1	0	1
13(1)	1	1*	1	2
13(2)	1	0	1	2
13(3)	0	0	1	1
13(4)	0	0	0	1
14(1)	0	0	0	1
14(2)	0	0	0	1
14(3)	0	0	1	1
15	0	0	0	NA

Note: * denotes that gender determinations based on the proximal and distal ends of the same bone.

MNI of two this means that at least one, and possibly both individuals, are female. Layer 12 has one male and one indeterminate gender determination. These likely represent a single individual. Layer 13(1) has a strong male and a strong female indicating that the MNI of two is represented by one male and one female. However, the gender of distal metatarsal specimen (#1439) is indeterminate. Layer 13(2) has a single definite male determined from a distal metatarsal and a definite female determined from a proximal radius. The MNI of two supports the presence of both a single male and a single female bison. These gender determinations may also reflect some mixing of layers 13(1) and 13(2). Layer 13(3) has one definite female indicated, based on a distal metacarpal. This corresponds with a single MNI. Layers 13(4), 14(1) and 14(2) have no specimens to provide gender evaluations. Thus, each of their single MNI is of indeterminate gender. Layer 14(3) has a single definite female indicated by a distal tibia.

In considering male to female ratios of the bison represented for the time spanning layers 8 through 14, there are 5 males, 7 females and 7 indeterminate individuals. Three layers have both genders present. Two of these layers, 8(2) and 13(1), have spring/summer seasonalities suggested by the immature bison, and 13(2) has unaged immature remains. During spring there may be some preference of male bison over the females with calves. This has been proposed by Jochim (1981: 81-83), Speth (1983: 84-159) and Brink (1992) based on the varying fat reserves between rutting males in the fall, pregnant females in the spring and barren females. However, the presence of females and the immature bison in all three of these layers indicates that these females and young were not being ignored. Due to a small sample size, vague seasonalities and likely stratigraphic mixing of some sublayers this does not provide any strong contradictive evidence to this proposed pattern. There is also a choice for males, as indicated by their presence in these layers. As may be surmised, hunters "generally seek large, fat animals" . . . "although in times of hunger probably any susceptible one may be killed" (Marks 1976: 105).

The bison carpal and tarsal measurements are presented in Appendix A, Tables 13, 14 and 15. These data may be used for gender evaluations. Morlan (1991) has plotted distributions to reveal clusters. However, with this small sample size such an approach is not possible. It may in fact result in clusters because of its small size, whereas larger samples may produce a complete range (Walde, personal communication October 2, 1992). Therefore, these data are provided for use by others in intersite analyses using larger sized samples.

6.5.2) Other Bone Measurements

Measurements of the bison skull in layer 10 are provided in Appendix A, Figure 1 and Table 16. Other bison bones measured are presented in Appendix A, Table 17, 18, 19 and 20. They are useful in evaluating sizes of individual bison from the different layers in a general manner. They may also be used by others in developing larger databases of bison measurements to employ in bison species studies. Not many bison measurements are available for the time-span 3000 to 5000 rcy B.P. These data can start to add to this poorly known time, just following the transition from larger species of bison to the modern species (see Frison 1991: 267-275; Morlan 1992a; Wilson 1978: 9-22; Walker 1992: 101-102).

There are too few and fragmented remains of other fauna to obtain adequate measurements. Some canid longbones allow a few measurements (Appendix A, Table 21). Complete occlusal portions of canid teeth are measured for comparisons and are presented in Appendix A, Table 22. It is unfortunate that more measurements can not be obtained for these canid remains. A better assessment of domestic canid to wolf or coyote identifications may have been made. However, these measurements can provide measurements that reflect the wolf-sized and coyote-sized specimens to some degree, though this still remains subjective.

6.6) Summary and Discussion

Cultural and natural factors have varyingly modified each layer's fauna. Comparison with taphonomic processes noted in Chapter 4, cultural modifications (e.g. cutmarks & impact scars), percentages of burned bone (as a cultural indicator) and percentages of identifiable bone allow some general assessments of bone modifying factors for each layer.

Layer 8(1) has 25% of its bone extremely modified between Stages 4 to 6 of Behrensmeyer's (1978) six stage classification, and between 60% to 70% at least minimally weathered (Stage 1) with some longitudinal cracking. Rounding of the bone surfaces suggests water erosion as a dominant process related to the geomorphic location of the site (see Chapter 4). Most other lower layers have a steeper upper portion of the slope and a flatter bottom portion within the excavation block. Some root erosion and carnivore/rodent gnawing is recognized. Though no cutmarks or polished bone is noted, some butchering may be indicated by chipped or impact marks on nine bones. Still, 38% of the bone in this layer is identifiable and at least 14% is burned. The percent of identifiable bone is likely inflated due to backplotting point-provenienced identifiable bone for the sublayers, with more unidentifiable bone remaining sorted only to layer 8 designation. Calcareous deposits may have helped preserve the bone to some degree; however, most bone is still fragile. This impression is perhaps supported by the slightly higher amount of excavation and post-excavation damage in this layer.

Layer 8(2) has 13% of its bone extremely weathered, as above. It has a greater amount of root etching (about 5%) and some minimal gnawing. The one noted cultural alteration includes one butchering impact. Although burned bone makes up at least 15% of the bone, 46% of the bone in this layer is identifiable. This percentage of identifiable bone is likely inflated on account of the same methodological reasons as layer 8(1). The calcareous deposits, again, may have helped preserve the bone. Also, this sublayer only has 179 pieces of bone.

Layer 9 has about 18% of its bone moderately weathered with some minimal root etching indicated. A moderate percentage of the bone is identifiable (24%) and much of the bone has calcareous deposits on it. The layer is intermittent and the soils are primarily colluvial in origin. Weathering seems to have caused much of the fragmentary nature of this assemblage. However, eight cut-marked bones and a bone that is cut through indicate some cultural influences, but only 2% of the bone in this layer is burned. Based on the cutmarks, butchering activities are suggested as a prevalent cultural modification of bone.

Layer 10 has 14% moderately weathered bone with little gnawing or root etching. Few cultural alterations are noted, although 10% of the bone is burned. A relatively low 18% of the faunal remains is identifiable. Weathering has had a fair influence on the degeneration of these remains with some additional cultural influences indicated by burned bone.

Layer 11 has 13% of its bone moderately weathered. About 3% of this is root etching, indicating a period of relative vegetation stability. Six bones with cut-marks, 11 butchered bones and a few other bones that include possible tools reflect the cultural modifications. Also, 26% of the bone is burned and 16% of the bone is identifiable. This may indicate that cultural factors have had a greater influence in bone degeneration compared to the other assemblages.

Moderate weathering, considerable gnawing and root etching is evident on 12% of layer 12 bone materials. This amount of weathering is just below the average for all the layers. More root etching indicates, as in layer 12, a time of relative stability allowing vegetation to become better established. Increased amounts of gnawing reflect the presence of canids and some rodents. Over 20 bones with cutmarks are noted as well as other butchering impact indicators. Burned bone makes up 22% of the total bone. The slightly lower percentage of identifiable bone (16%), may reflect a greater influence from cultural factors in addition to moderate, natural, post-depositional factors.

Layer 13(1) has only 7% of its bone moderately weathered with minimal root etching and gnawing. Seven bones with cutmarks are noted and four with butchering scars. Burned bone is well represented (28%) and only 14% of the bone is identifiable. It seems that cultural factors are a dominant source of bone modification at this layer with relatively less influence from natural processes.

Moderately weathered bone, considerable gnawing (16 specimens) and some root etching have modified about 9% of layer 13(2). Sixteen cutmarked, seven butchered and twelve other altered bones indicate above average cultural modifications. Burned bone is 41% of the total bone and only 14% of the bone is identifiable. This seems to reflect considerable modifications from cultural factors, with some post-depositional natural modifications.

Layer 13(3) has only 7% moderately weathered bone with a few indications of gnawing and root etching. Only a couple of cultural modifications are noted. However, burned bone is a considerable 46% of the total faunal assemblage. This indicates a strong cultural influence and may be reflected in the moderate percentage (20%) of identifiable bone.

Layer 13(4) has a considerable amount (25%) of its bone heavily weathered, with some indications of gnawing activity. Only a few cultural modifications are noted, and 14% of the bone is burned. A moderate amount (29%) of the bone is still identifiable and may reflect fewer modifications from cultural factors. This may possibly reflect the removal or disintegration of smaller unidentifiable remains by slopewash as is indicated by greater weathering of material in this sublayer.

Layer 14(1) is moderately weathered (9%) and includes some gnawing activity. No cultural modifications are noted. However, burned bone is 21% of the bone assemblage. A fairly high percentage (33%) of the bone is identifiable which may reflect the lessened natural modifications. However, the greater amount of burned bone indicates that much of the bone reduction in this sublayer could be caused by cultural factors.

More extreme weathering is indicated in at least 21% of the bone from layer 14(2). Some gnawing is also present. Only one bone has cut-marks on it and a minimal 0.2% of the bone is burned. Yet 47% of the bone is identifiable. This must reflect minimal cultural modification and possibly the degradation or removal of smaller unidentifiable remains by slopewash processes, as indicated by the greater weathering.

Layer 14(3) is also considerably weathered. About 34% of the bone is extremely weathered, and some root etching is also noted. Only one bone has a butchering impact scar and a very low amount (0.5%) of the bone is burned. Identifiable bone makes up 44% of the total bone. This relatively high amount also reflects limited cultural alterations of the faunal remains and may reflect the removal of smaller, unidentifiable materials by the greater natural post-depositional factors.

Layer 15 has 22% extremely weathered bone with no apparent gnawing or root etching. No cultural alterations were noted. A very low 0.7% of the bone is burned. Still 29% of the bone remains identifiable, again, likely due to the low cultural modifications and post-depositional removal of smaller unidentifiable bone remains.

The percentage of identifiable bone seems to correlate inversely with the degree of cultural modification factors, including burned bone (see Tables 6.1, 6.2 and 6.3). This seems to indicate the presence of increased cultural influences on the assemblage through time. Also, there is more weathering in layers which have an increased percentage of identifiable elements. This seems to indicate that small unidentifiable elements are removed by increased post-depositional processes but the larger, denser elements remain and are still identifiable. Increased cultural modifications makes bone more susceptible to weathering. This may also have the influence of increased bone into the "unidentifiable" category. Also, the types and distributions of bones in each layer have not been considered. As reviewed earlier in this chapter, differential element and faunal taxon representations can alter this general perspective considerably (e.g. Lyman 1992; Lyman and Fox 1989). Representative taxons and elements are summarized here, but distributions and features that indicate more specific cultural factors, are discussed in the following chapter.

An NISP count and MNI summarize the contents of the fauna for each layer. Some measurable bones provide some size and gender indications, but the sample size for most layers is so small that these are not useful for intrasite comparisons.

A summary of the fauna for each assemblage follows. In Appendix B, Table 4 a summary of fauna and seasonality for each assemblage data are also provided.

Layer 8(1) has bison, lagomorph, deer, antelope, rodent and bird remains represented in its inventory. A single MNI of mature bison is a probable female. Two MNI of immature bison are estimated to be about one month old and seven months old. This suggests at least two occupations or continued occupation during spring/mid-summer and fall/winter. A deer and possibly a pronghorn is also present in one of these assemblages. At least one jackrabbit and one indeterminate microrodent is represented. The presence of a corvid, crow-sized bird, may support the spring/summer seasonality interpretation.

Layer 8(2) contains only bison remains. Though an initial MNI indicated a single adult bison, gender determinations on longbones using Walde's (1985) method indicate the presence of both a male and a female. Thus, two adult bison are thought to be represented in this layer and may represent some mixing of the bones of the mature bison represented in layer 8(1). Also a very young, less than one week old, bison is represented, as is another one-to two-months old. There is a slim possibility that this older bison calf is the same one as the one-month old individual represented in layer 8(1). These calves' ages suggest a spring/ summer season of occupation. A talon from a falcon, likely a red-tailed or Swainson's hawk, is also present, supporting the warm season for occupation.

Layer 9 contains bison, deer, rodent and toad remains. One mature bison MNI is indicated. However, a definite male and an indeterminate specimen are calculated for this layer. This may suggest that two individuals are represented, but more likely indicates a single male individual. No immature bison are represented in this layer. An immature deer is present. One Richardson's ground squirrel, one indeterminate microrodent and a Canadian toad are also represented.

Layer 10 includes bison, canid and rodent remains. Two MNI of mature bison are represented, one of these is a male. No immature bison are present. A single red fox and large *Canis sp.* are also represented. Some measurements are available for a nearly complete bison skull and a candid's right ulna, radius and scapula. Rodents in this layer include a Richardson's ground squirrel and a Gapper's red-backed vole.

Layer 11 contains bison, deer, canid, mustelid, rodent and toad or frog remains. Two MNI of mature bison are indicated, and at least one of these are is a female. Also, an immature bison is represented by a left femur and four axial specimens, of which three (including a horizontal ramus) indicate an age of about one year. This suggests a general spring/early summer seasonality. At least one immature deer is represented, and is estimated to be about 11 to 12 months-old, based on unfused phalanges. Two large *Canis sp.* individuals are represented, one wolf-sized and another mid-sized individual. A canid phalanx and metacarpal fragments are burned, and several cutmarks are noted on medial and lateral aspects of a distal humerus (see Figure 6.2). A skunk is represented by a portion of a maxilla. A Richardson's ground squirrel and a thirteen-lined ground squirrel represent the larger rodents, and a least chipmunk represents the microrodents. A toad or frog from one of the feature flotation samples is in this layer.

Layer 12 contains bison, canid, lagomorph, rodent, toad or frog, mollusk, gastropod and reptile remains. A single mature bison MNI is an indeterminate gender. All four of a bison's quarters are represented, as well as axial elements. Eight immature bison specimens, including left and right forelimb and some axial elements, represent an approximately seven month old animal. This suggests a fall/winter season of occupation. Three canid individuals are represented in this layer. They include a mature *Canis sp*.., an immature *Canis sp*.., and a red fox. A single jackrabbit is represented by a distal right humerus. Five rodents include a least chipmunk, two deer mice, a western harvest mouse and a vole. Flotation analysis of feature samples recovered three toad or frog fragments, three mollusk shell fragments, and at least six gastropods. Maxilla fragments, probably fish, are also in this layer.

Layer 13(1) has bison, canid and rodent remains. Two mature bison MNIs are indicated, and gender determinations suggest that one is male and one is female. These individuals are represented by all four quarters and axial elements. A single immature bison MNI is depicted by paired mandibles, which indicate an age between two to three months old. This suggests a summer season of occupation. A single canid tooth fragment is considered to belong with a specimen in layer 13(2) and was likely moved by rodents. Two microrodents from this layer include a least chipmunk and an indeterminate microrodent. Several specimens from a Passeriform are possibly robin and may corroborate the spring/summer seasonality.

Layer 13(2) contains bison, canid, mustelid, lagomorph, rodent and toad or frog remains. At least two mature bison are present, and are identified as a male and a female. These bison are represented by all four quarters and axial elements. With this many remains, the close association of layer 13(1), and the consistent separation of male and female individuals in both layers, there is a likelihood that these layers have been mixed somewhat. Thus, the mature bison MNI of two may represent the same two individuals in both layers. However, immature bison specimens seem to separate out to some degree between layers 12, 13(1) and 13(2) because left horizontal rami are found in each layer. Five specimens in layer 13(2) indicate an immature bison, but are weathered and fragmented so that they cannot provide an age estimate. At least one immature *Canis sp.* is represented in this layer. A mink is represented by a single canine tooth, and a jackrabbit and a snowshoe hare are both represented by 45 bone fragments, overall. A northern pocket gopher and a Gapper's red-backed vole are present. Four fragments of a toad or frog are recovered from a flotation sample in this layer.

Layer 13(3) contains bison, canid and rodent remains. A single bison MNI is primarily represented by front right elements and is determined to be female. An immature bison MNI is minimally represented by a single right tibia fragment. It is possible that this is a portion of the immature individual represented by two specimens in layer 13(4). A coyote-sized *Canis sp.* is represented by burned third and fourth right tarsals. One Richardson's ground squirrel and a least chipmunk is also present in this layer.

Layer 13(4) has bison, rodent and bird remains. Three animal quarters represent one mature bison of indeterminate gender. A couple of immature bison remains are estimated to be one month old. This suggests a spring/summer season of occupation. Three microrodents include a Gapper's red-backed vole, a prairie vole and a deer mouse. Two birds in this layer include a crow-sized corvid and a mallard duck. These suggest a spring/summer season as well.

Layer 14(1) contains bison, deer, and rodent remains. One mature indeterminate gender bison MNI is represented by a few forelimb and hind axial units. No immature bison are noted. A mature deer MNI is represented. At least two Richardson's ground squirrels, a northern pocket gopher and a meadow vole are also in this layer.

Layer 14(2) includes bison, deer, lagomorph and rodent remains. One mature bison MNI of indeterminate gender is represented by axial, left forelimb and left hindlimb elements. Four specimens of an immature bison are also present. Age estimates from two portions of the same left mandible indicate about a three week old individual. This suggests a spring/early summer seasonality. Eight specimens also represent a mature deer. Ten specimens indicate at least one jackrabbit in this layer. Two gapper's red-backed voles, a western jumping mouse and another indeterminate vole's mandibles and assorted remains are found in a cluster, suggesting deposition by an owl pellet or canid disgorge. Another Gapper's red-backed vole and an indeterminate larger rodent are also found separately in this layer.

Layer 14(3) includes bison and rodent remains. A single adult bison MNI is represented by a right forelimb, a left hindlimb and a few axial elements. It was determined to be female. No immature bison remains were noted. A northern pocket gopher and a Gapper's red-backed vole represent the rodents for this layer.

Layer 15 contains bison, canid and fish remains. Fragments of an adult bison of indeterminate gender are present. Two canid MNI are reflected by both coyote-sized and wolf-sized specimens. Two fish are represented by two different vertebrae and a brachiostegal ray which may be from a catfish.

CHAPTER 7

Redtail Site Features and Patterns

7.1) Introduction

There are 69 features identified in the excavation of layers 8 through 15 at the Redtail site. Spatial patterning of these features and other material in each layer or sublayer provides a glimpse of the living floors on which cultural activities occurred, reoccurred and were subsequently modified by natural processes. The general feature-oriented approach that is used to describe and interpret occupations in the present study is based on the following ideas.

> *Features* embody the patterning of an assemblage and are frequently given interpretative terminology, e.g. knapping pile, post-hole, sleeping hollow. More generally, however, features are simply observations of apparent patterning, and may or may not be of archaeological significance. Leroi-Gourhan (Leroi-Gourhan and Brezillon 1972, p. 325), makes a distinction between *obvious* features (features identified during excavation) and latent features (features identified during analysis). I prefer to make a distinction, between *descriptive* terminology used to refer to any aspect of patterning detected, without any implication that it is the product of human activities, and *interpretative* terminology which seeks to apply a particular interpretation to the patterning observed. Interpretative terminology is often applied during excavation to unambiguous features such as hearths, whilst less characteristic features such as areas of artifact concentration and impoverishment may never be attributed specific interpretative terminology, although contributing to the overall interpretation of the site (Johnson 1984: 77).

Types of interpretive features recorded during excavations include varieties of hearths, pits, ash concentrations and charcoal concentrations. These features are described for each layer, referring to clusters and associations. Six of these features also have flotation sample analysis data. Distribution patterns of bones, lithics and FBRs are presented with more descriptive terminology. These patterns are discussed in relation to the interpretive and some other descriptive features. Interpretive terms, relating to functions, and descriptive terms, relating contents and form, are interspersed throughout most of the discussion.

7.2) Feature Analyses Methodology

Features were recorded in the field using a standardized form which included provenience data, sampling size, matrix description, associations, a planview and a profile map. Matrix descriptions and associations included notes on attributes such as ashy soil texture, charcoal concentrations, the presence of burned and unburned bone, "greasy soil", the soil color, amount and location of oxidation or red stains, presence of flaked stone or pecked lithics, and fire-broken rock. Other comments noted potential re-use, as reflected by multiple oxidation or ash/charcoal concentrations associated within or adjacent to features. Some basic metric and nonmetric attributes included the feature's length and width, planview shape, directional orientation, depth, and profile shape. These data may help to delimit the activities that produced these features and provide some standard basis for comparisons.

Seven soil samples were submitted from features to the University of Winnipeg for flotation analysis (Deck 1992), in order to study any preserved, carbonized dietary evidence. A handful of soil from each sample was retained prior to flotation. The remainder of the soil sample was put into buckets with water and 0.5 grams per litre of dispersant (sodium hexametaphosphate, or commercial "Calgon"). The dispersant aided in the disaggregation of clay particles. The soil in the bucket was agitated and the floating organic material poured through a stack of soil sieves (mesh sizes 4.0, 2.0, 1.0 and 0.5 mm). This was repeated until all the floating material was removed. The sample's remaining residue was then poured into another bucket with a 1.0 mm mesh inserted inside. This constituted the "heavy fraction" or that material which did not float. The material from the soil sieves, or the "light fraction", and the "heavy fraction" were transferred to trays lined with paper towels and left to dry. Each fraction was then weighed in grams and the weight was recorded (Deck 1992: 1).

Each fraction was sorted using a binocular microscope which enables magnifications up to 100x. Artifacts, bone, shell, charcoal, seeds and insects were removed. Charcoal and nondiagnostic bone fragments were not sorted from the 1.0 and 0.5 mm fractions. All of the sorted material was quantified by the number of pieces present and weighed (in gm). Then they were placed into labeled vials by fraction size (Deck 1992: 1).

Cellular structure of wood was preserved in charcoal specimens allowing for the identification of species (Salisbury and Jane 1940; Leney and Casteel 1975). The cellular structure can be viewed by snapping the specimen along three different planes (transverse, tangential or radial) (Deck 1992: 1). Smart and Hoffman (1988: 167-205) further discuss the identification and interpretation of charcoal from archaeological sites.

General distributions of bone, chipped stone and FBR materials are compared to each other and to the feature distributions. Bone and burned bone are mapped for each layer or sublayer. General distributions of lithic debris, stone tools and cores are presented together. Finally, FBR and locations of charcoal samples are presented on the same distribution map. Charcoal was collected as general samples (denoted on the maps) but some collected with the flotation samples may not be denoted on the maps. General charcoal samples may be associated with descriptive feature patterns, and likely reflect activity locations. The categories for distribution maps are based on frequency groupings of 0, 1 to 8, 9 to 39, 40 to 100 and >100. These groupings are determined on the clustering of the material (bone, debitage and FBR) frequencies on a per unit basis through all layers. Groupings, therefore, reflect the actual frequency clusters of materials rather than purely arbitrary subdivisions. This provides a better relative baseline for comparisons between layers.

This approach provides a general view of the main activity areas and their amount of overlap. A feature-based approach and use of some horizontal relationships from planviews add some clarity to the specific activity areas. Activity information revealed by these approaches is reviewed in comparison to the social-context model proposed by Yellen (1977) and the activity-specific models noted by Whallon (1973), Binford (1978) and Johnson (1984: 93). The interpretive models proposed by Murray (1980) deal with discard location patterns about habitation structures. However, noncultural factors must also be considered as agents in altering or producing patterning of materials. The presence of canids at the site has undoubtedly had an influence on bone distributions (Blumenschine 1988: 483-502; Kent 1984:178-184). Also, many other post-depositional influences have modified occupational patterns. These primarily include graviturbation, faunalturbation, cryoturbation and floralturbation processes (Behrensmeyer and Hill 1980; Schiffer 1987; Wood and Johnson 1982: 539-605). These processes may physically group materials or may produce "apparent" groupings of remains due to differential preservation. Rodent disturbances are mapped with the feature location maps to indicate areas with potential for movement of materials between layers. The general distribution approach smoothes over most of the inconsistencies produced by these various natural processes, whereas a more specific spatial patterning approach would be influenced to a greater degree by natural processes. The feature-based interpretive orientation is used with some map planviews to providing some specific patterns for interpretation.

7.3) Feature Descriptions

Sixty-nine interpretive features were noted in layers 8 to 15. Table 7.1 presents provenience and descriptive data for these features. Each major occupation is discussed separately, from the upper layers to the deeper ones. Sublayer provenience is noted for each feature, when possible, and descriptions proceed through feature clusters in sequence.

Layer 8

Layer 8 contains 22 features identified during the excavations (Table 7.1). These include 8 hearths, 2 pits, 13 charcoal concentrations, 2 ash concentrations and 1 possible pithouse. Locations of these features are shown in Figure 7.1. It may be noted that six to eight features are associated directly with feature 13, a depression similar to a shallow pithouse (e.g. features #'s 8, 9, 10, 11, 12, 68 and possibly 14 and 15). Feature 13 is shown in profile (Figure 7.2) to be about 40 cm deep and 3.5 m across. The planview perspective outlined in Figure 7.1 indicates that this is not the full depth or diameter of the pithouse, and that it may be 4 m or more in diameter.

Feature 8 is a basin hearth located in the pithouse (Figure 7.1) in the more recent occupation, layer 8(1). It contains charcoal and ash-stained soil and measures 40 cm by 40 cm and is about 15 cm thick (Figure 7.3). A 3 cm thick oxidized area at the bottom is concentrated at the west edge of the bottom part of the hearth. A 1.5 cm thick white ash layer is in the middle of the charcoal blackened soil. This may suggest that the hearth had at least two main use events: with a hearth placed over an existing deeper basin-shaped hearth. The unsuccesful TL sample from this feature suggests that the hearth was not heated to a high temperature. It is likely, therefore, that this hearth was re-used several times, perhaps during two main episodes, using smaller low-heat fires.

Table 7.1 Redtail Site Feature Data

Feature Number	Description	Unit Location	Quad(s) Location	Layer	Thickness (cm)	N-S Extent (cm)	E-W Extent (cm)	Associations (see * below)
1	Surf. Hearth	124-5N 114-5E	NE,SE/NW,SW	13(2)	6	60	46+	FBR,F,BB,B,C
2(G)	Basin Hearth	121N 112-3E	NE,SE/NW,SW	11	15	60	55	BB,O,B,C
3(F)	Hearth	121N 112E	NE,SE	12	11	30	40	FBR,B,F,O,C
4(A&B)	Pit	121N 110-1E	NE,SE/NW,SW	12(2)	14+	52	55	B,BB,T,G,C
5(C)	Hearth	123N 109E	SE,NE	11	5	34 &50	32+ &30	FBR,BB,T,C
6(D)	Hearth	123N 110E	NW	13(4)	5	75	60	FBR,B,R,C
7(E)	Hearth	124N 113E	SE	13(2)	6	70	70	B,T,F,BB,C
8	Basin Hearth	124-5N 110E	NE,SE	8(1)	15	40	40	B
9	Char. Conc.	124N 111E	NW,NE	8(1)	4	35+	105	C
10	Surf. Hearth	124N 111E	NW,NE	8(2)	6	30+	55	C
11	Pit/Hearth	124N 109E	NW, NE	8(1)	10	15+	40	C
12	Pit	124N 109-110E	NE,NW	8(2)	18	20+	52	B,C
13	Pit-House	124N 108-111E	ALL	8(2)	39	351	98	FBR,C,FEATS
14	Pit	124N 108E	NW	8(2)	7	25	30	C
15	Surf.Hearth+C	123N 111E	NW,SW	8(1)	4	50 & 45+	22+ & 42+	C & C
16	Char. C	122N 111E	SW	8(1)	2	25	28	C
17	4x Char. C	120N 107E	NW,NE,SE	8(2)	1 to 2	4x20-25	4x18-30	C
18	Char. C	121N 106E	NW,NE	8(2)	6	18+	28	C
19	Char. C	121N 107E	SW	8(1)	1+	7	8	C
20	Char. C	120N 110E	NE	8(2)	1+	7	5+	C
21	Char. C	120N 110E	NE,SE	8(2)	8	27	12+	C
22	Ash C	121N 111E	SW	8(1)	2	23	36	A
23	Char. C	121N 112E	NE,SE,NW,SW	8(1)	3	70	50	BB,B,C
24	Char. C	121N 113E	NE,NW	8(2)	2	20 & 20	29 & 12+	C
25	Hearth	122N 106E	NE	8(2)	2	8	12	C,O?
26	Hearth	122N 114E	NW	8(1)	5	38	38	C,A

Table 7.1 Redtail Site Feature Data (continued)

Feature Number	Description	Unit Location	Quad(s) Location	Layer	Thickness (cm)	N-S Extent (cm)	E-W Extent (cm)	Associations (see * below)
27	Ash C	122N 114E	SE,SW	8(1)	3	50+	70+	B,C
28	Char. C	124N 108E	NE,SE	11	2	50+	50+	C,B
29	Surf. Hearth	122N 109E	NW,NE	10(2)	2	27 & 15	26 & 18	C,BB,R,FBR
30	Char. C	122N 113E	NE,NW,SE	11	4	3x20+	3x20+	C,B,FBR
31	Surf. Hearth	123N 107E	NE,SW	11	2 to 4	20 &25	20 & 13	FCR,B,BB
32	Surf. Hearth	124N 113E	NW,SE,NE	11(2)	3 to 4	10+,11, & 20	27,8, &16	C,B
33	Surf. Hearth	124N 108E	SW	11	4	50+	50+	C,FBR, B
34	Surf. Hearth	123N 113E	NW,NE,SE,SW	11	4	36	38	C,FBR,B
35	Char. C	121N 112E	SE,SW,NW,NE	11(1)	2 to 3	20-30	20-30	C,BB,B
36	Hearth	122N 108E	SW	11	5	40 & 18	15+ & 17	A,C,FBR
37	Hearth	121N107E	SE,NE	8(2)	7	66+	45+	R
38	Char. C	120N 110E	NW,SW,SE	11	2	40	40	C,A,FBR,B,R
39	Char. C	121N 111E	SE,SW,NE	11	3	50+	100+	C,A,FBR,B,BB
40	Hearth	123N 110E	NW,SW	11	8 to 10	65	60+	FBR,B
41	Char. C	123N 112E	NE	11	1	20	20	C
42	Char. C	124N 110E	SW,SE	11	2	110	33	C,FBR,B,A
43	Char. C	124N 111E	SE	11	4	20	22	C
44	Hearth	124N 108-109E	NE,NW	12	7	25	26	FBR,B,R
45	Char. C	124N 108E	NE	12	2	22	27	FBR,C,T
46	Char. C	123N 106E	SE,NE	12	2	17	16	R,C,BB,FBR
47	Hearth	124N 109E	NE	12	9	36	30	R,C
48	Char. C	124-3N 108-9E	SE/SW,NW,SW	12	6+	130	130	C,A,B,FBR
49	Hearth	123N 109E	SE	12(2)	3	30	31	C,FBR,BB
50	Hearth	123N 108-109E	NE,NW	12	5 to 8	27	36	C (TWIGS)
51	Char. C	123N 108E	NE	12	5	30	37	C,FBR,B
52	Hearth	123N 107E	SE	12	3	30	32	BB,C

Table 7.1 Redtail Site Feature Data (continued)

Feature Number	Description	Unit Location	Quad(s) Location	Layer	Thickness (cm)	N-S Extent (cm)	E-W Extent (cm)	Associations (see * below)
53	Hearth	122N 108E	SE	12	3	30	35	C,FBR,F,B
54	Char. C	121N 105E	SE	12	2	50+	45+	R,FBR,F
55	Char. C	121N 107E	NW,NE,SE	12	4	32	100+	C,BB,R,FBR
56	Char. C	122N 110E	NE	12	3	40+	55+	B,FBR,F,O
57	Char. C	122N 109E	NE	12	2	12	12	C
58	Char. C	120N 110E	SE	13(1)	5	20	32	C,FBR,R,B,F
59a	Hearth	121N 112-3E	SE,NE/SW,NW	13(2)	5	67	75	FBR,BB,B,O,C
59b	Hearth	121N 112E	SE	13(3)	5 to 7	35	40	B,C,BB,FBR
60	Char. C	122N 109E	NE	13(2)	3	22	19	A,C,R,B,F
61	Hearth	122N 111E	NE	13(4)	3	13+	25	B,FBR
62	Char. C	122N 112E	SE,NE	13(2)	2	30	35+	C,A,FBR,R
63	Char. C	122N 113E	NE,NW	13(1)	4	20	45	C,F,FBR
64	Hearth	122N 113E	SE,SW,NE	13(4)	3	35	80	B,FBR
65	Hearth	123N 108E	NE	13(1)	10	30	15+	FBR,B,C
66	Pit	124N 111E	NE	13(1)	15 to 20	33	25	B,FBR
67	Surf. Hearth	123N 112E	SW	13(1)	2	40	34	C
68	Hearth + Ash	124N 110E	SW,SE,NW,NE	8(1)	3	30 to 40	40	A,C
69	Bison Skull	123N 109E	NW	10(2)	NA	NA	NA	B

* Codes for associations are as follows:

A=Ash, B=Bone, BB=Burned Bone, C=Charcoal, F=Flakes, FBR=Fire-Broken Rock, O=Ochre, R=Rock

Note:

These associations are listed in order of frequency and closeness of association.

Multiple concentrations of features have measurements listed in the order given for the units and quads.

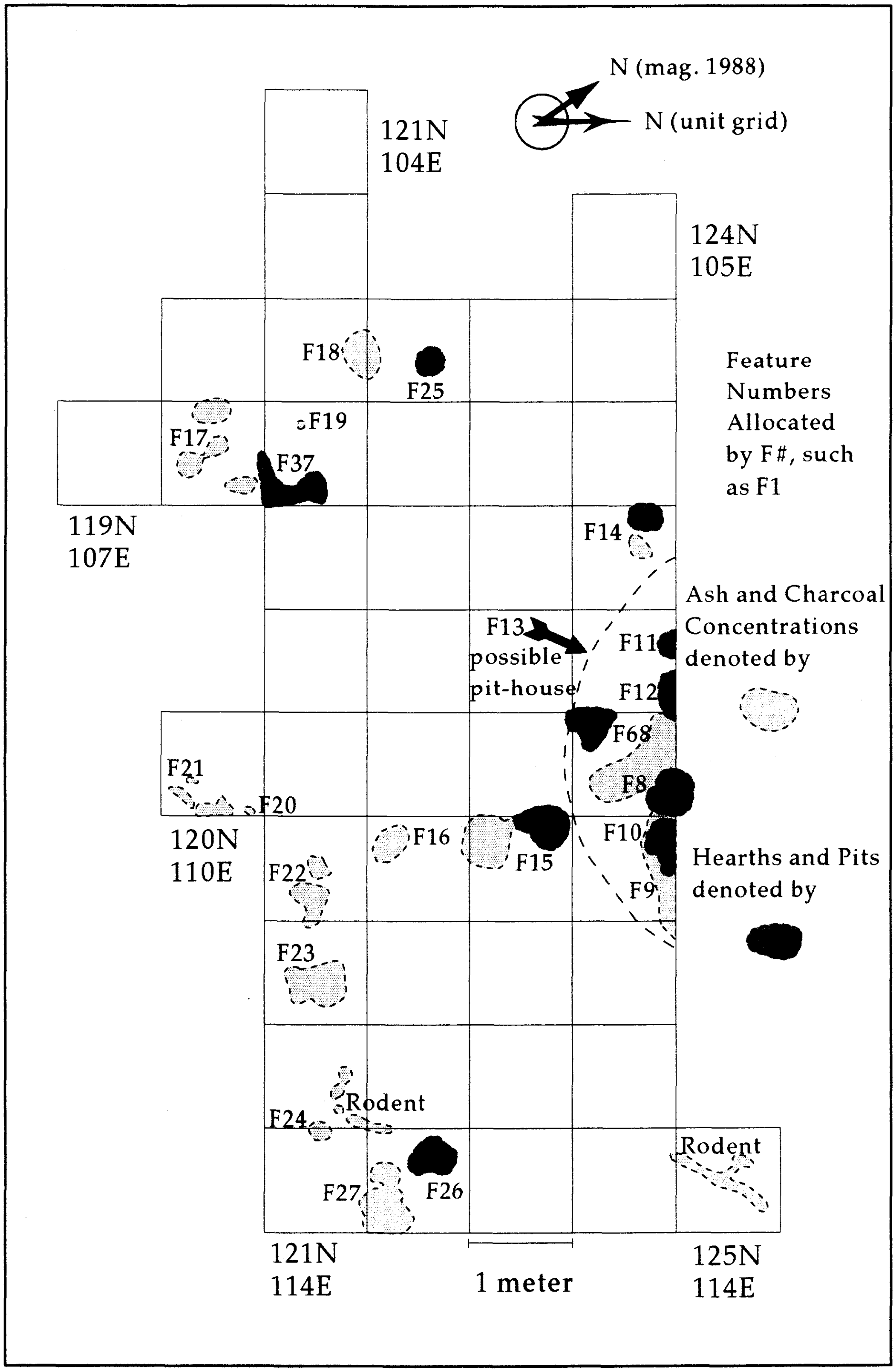


Figure 7.1 Layer 8 Features at the Redtail Site (FbNp-10)

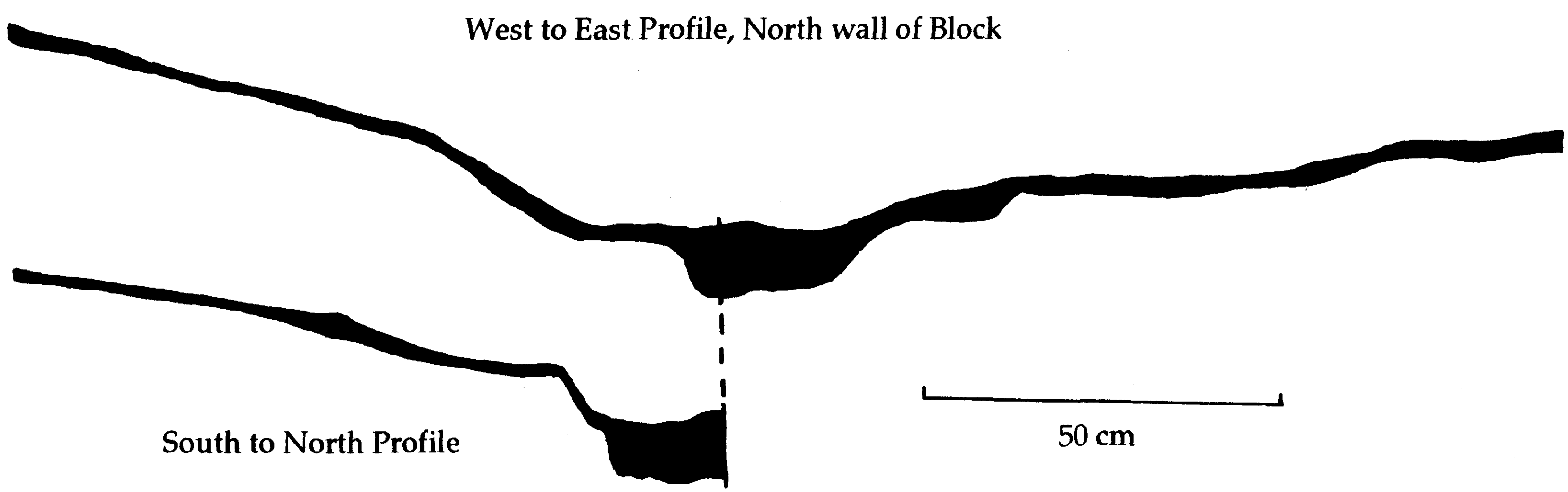


Figure 7.2 Feature 13, probable living structure/pithouse, profiles

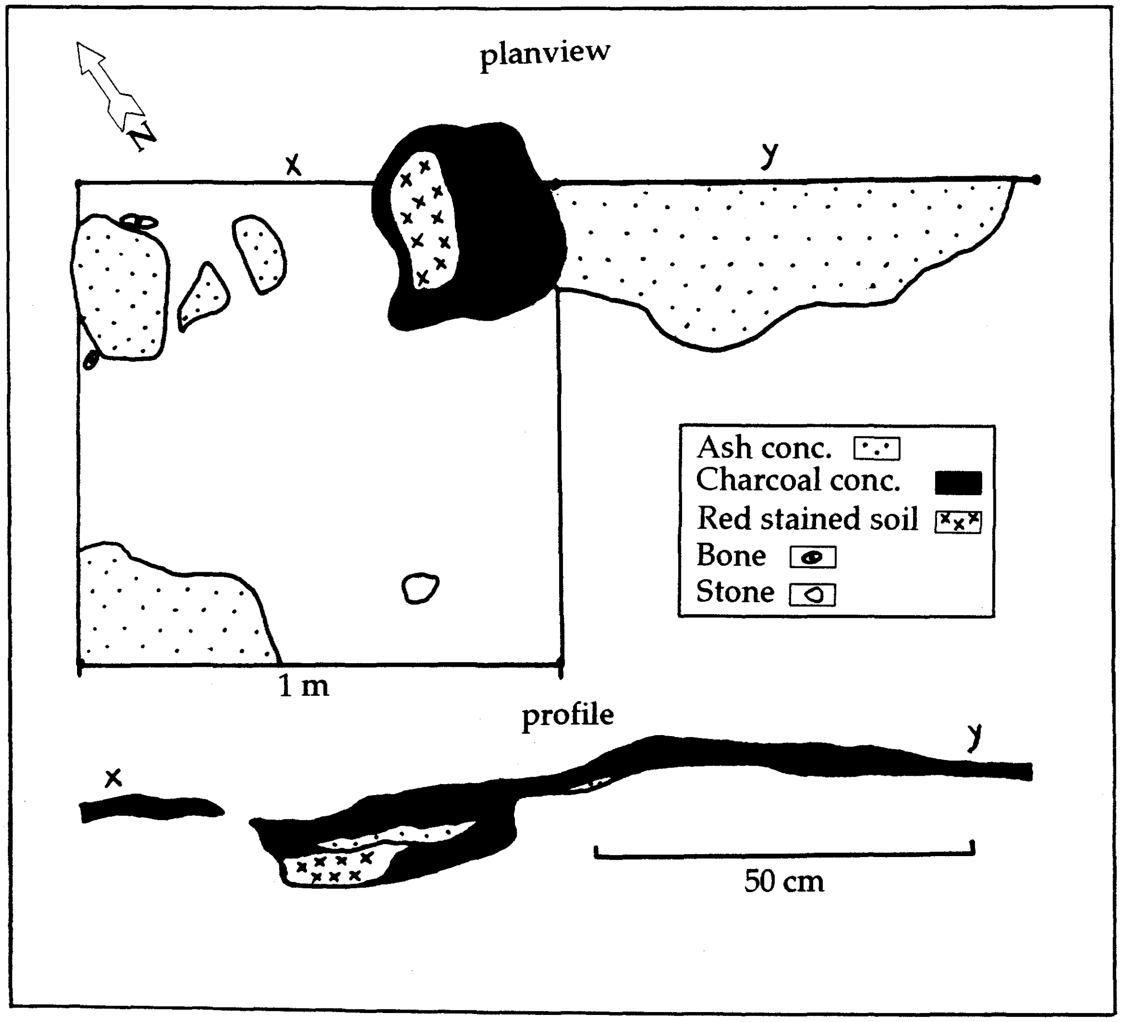


Figure 7.3 Feature 8, basin hearth planview and profile

Feature 9 is a charcoal concentration that probably accumulated from use of the basin hearth (Feature 8) above (Figure 7.1). Presumably, as charcoal and ash were scooped out to re-use the hearth the charcoal accumulated downslope, and toward the margins of the pithouse. Feature 11 is a smaller hearth. It consists of mottled charcoal-stained soil with a red oxidation along one edge of the rounded, v-shaped hollow (Figure 7.4). Another smaller, 12 cm diameter, oxidized area is adjacent to the pit-like margin. Though the deepest part of the pit is 10 cm, a 50 cm by at least 15 cm area contains charcoal and charcoal-stained soil about 5 cm thick. Also, at layer 8(1) in the pithouse there is another small surface hearth (feature 68), and there is a larger scatter of ash concentrations throughout unit 124N 110E (Figure 7.1). There is ash associated with the small hearth immediately around it. Other ash is concentrated in the northwest, southeast and northeast quadrants of unit 124N 110E and is probably associated with the basin hearth (Feature 8).

The lowest occupation of the pithouse, layer 8(2), contains a surface hearth, feature 10, and a squarish pit, feature 12. These are about a metre apart (Figure 7.1). A few bone fragments were found near the pit feature and a few within it. The pit has steep sides, is deep (18 cm) and has a flat bottom (Figure 7.5). It breadth is 52 cm and probably about the same north and south. Fill consists of black, charcoal-stained greasy soil, with some red oxidation present on one edge in the deepest part of the pit.

Nearby, and perhaps associated with the pithouse, were features 14 and 15 (Figure 7.1). The first of these is a relatively small, oval-shaped (25 cm by 30 cm), shallow (7 cm) charcoal and black organic-stained soil pit. This pit is in layer 8(2) and may be associated with several sandstone and granitic rocks, a small charcoal and ash stain, a canid humerus, a bison calcaneus and other bone fragments (Figure 7.1). The other, feature 15 in layer 8(1), is a surface hearth with

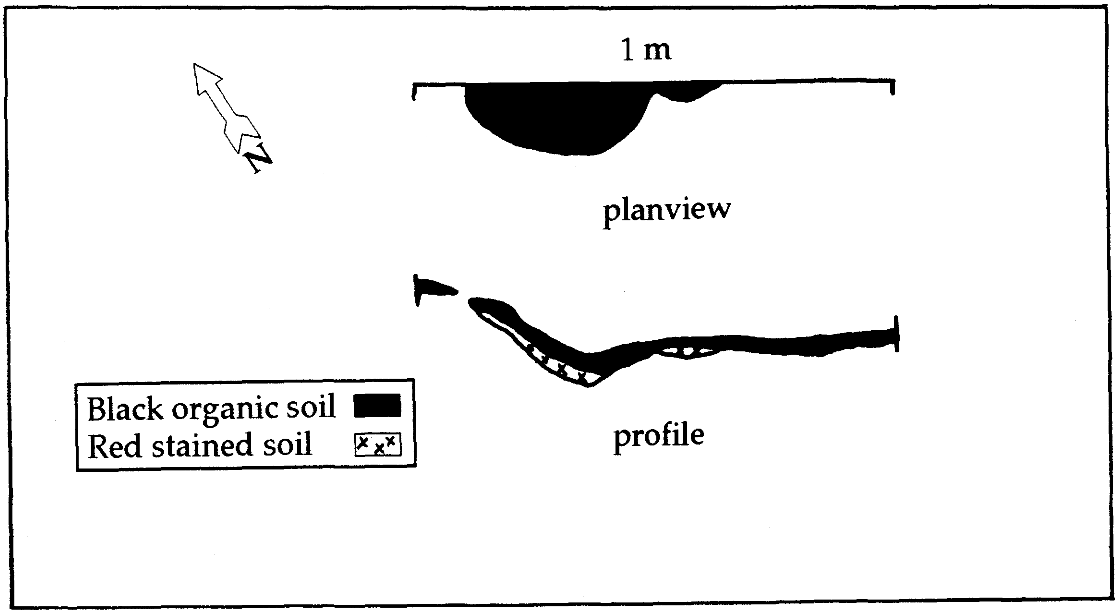


Figure 7.4 Feature 11, hearth planview and profile

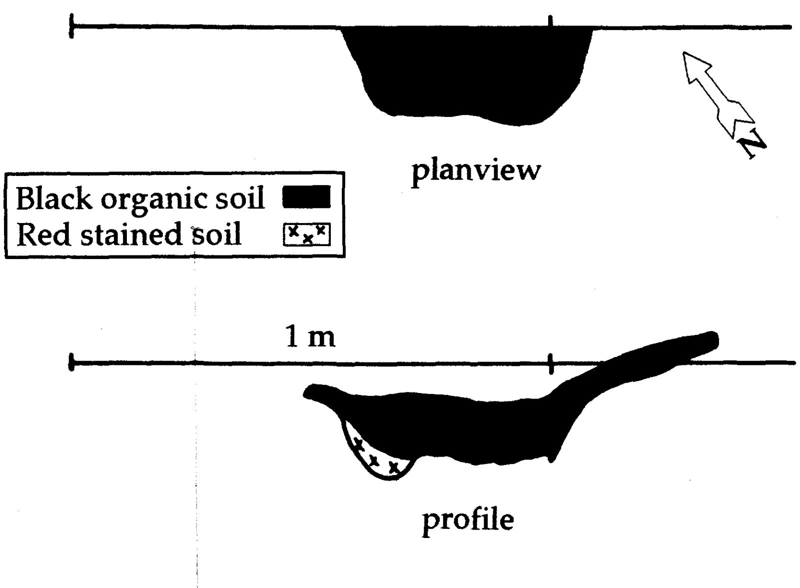


Figure 7.5 Feature 12, pit planview and profile

an associated charcoal concentration. Both these features are about 50 cm by 50 cm in diameter and about 4 cm thick. Less than a metre away is a charcoal stain, with red oxidation above the blackened soil. This stain, feature 16, is a very thin (2 cm thick) and small (25 cm by 28 cm) concentration. The red earth on top suggests the overturned contents of a hearth, the result of cleaning out a used hearth. Feature 15 is the nearest hearth to this stain and may thus be associated with it.

A few features cluster upslope in layer 8(2) (see Figure 7.1). These include a larger hearth (Feature 37), a small hearth (Feature 25) and about six various sized charcoal concentrations (Features 17, 18 and 19). Features 17 and 19 are probably associated with the larger (7 cm thick), elongated (66 cm by 45 cm) hearth. The small round (7 cm by 8 cm) shape of the feature 19 charcoal stain may have resulted from infilling the depression left by a tripod leg if one were used over the feature 37 hearth. A cluster of four charcoal concentrations (feature 17) appears to be "clean-out" deposits of charcoal-stained soil from this hearth (feature 37). Another larger charcoal stain (feature 18) is 6 cm thick and at least 18 cm by 28 cm . It seems unlikely that the small (8 cm by 12 cm), shallow (2 cm) hearth (feature 25) nearby could have produced this much debris. Perhaps another larger hearth exists upslope outside the excavation block, or this may be deposits from the larger feature 37 hearth.

A line of features occurs along the south edge and the eastern half of the block. Features 20, 21, 23 and 24 are charcoal concentrations, feature 22 and 27 are ash concentrations and feature 26 is a hearth. All of these, other than three charcoal concentrations, are associated with layer 8(1). The layer 8(2) feature 24 is small and thin. However, the other two features, 20 and 21, are thicker (8 cm) and larger (27 cm by 12 cm) with surrounding smaller concentrations of charcoal. Several pieces of carbonized grass and twigs were noted within these.

In layer 8(1) feature 22 is a thin (2 cm thick) relatively large ash concentration (23 cm by 36 cm). Feature 23, though defined as a charcoal concentration, also contains burned bone and unburned bone. This would appear to be midden-like material. Feature 26 is a well-defined hearth 38 cm round in diameter and five cm thick (Figure 7.6). This hearth is associated with several complete or nearly complete bones and feature 27, which consists of two substantial ash clusters with bone and a smaller charcoal concentration containing burned bone.

Layer 9

Layer 9 does not contain any interpretive features, but some descriptive patterns will be discussed with the general material distributions, later.

Layer 10

Layer 10 is closely associated with layer 11 in many areas but, generally, an arbitrary or natural separation was maintained during excavation and is thus applied in the analyses. In the center of the block some compression of these layers is noted, with the added difficulty that layer 10 separates into two sublayers. The only features in layer 10 are present in this area. Layer 10(2) contains a nearly complete bison skull, feature 69, and a composite hearth, feature 29. These are presented with the layer 11 features in Figure 7.6.

Feature 29 consists of two closely associated shallow (2 cm thick) surface hearths, one larger (27 cm by 26 cm) and one smaller (15 cm by 18 cm) in size (Figure 7.7). These hearths are interconnected by a dispersed charcoal concentration which extends southeast away from the hearths, downslope. Fire-broken rock and burned bone is associated with these hearths, as well as a cluster of smaller pebbles in the charcoal stain area immediately to the southeast.

In the unit to the north, 123N 109E, also in layer 10(2), there is a nearly complete bison skull (Feature 69). It was positioned upside-down with the nose

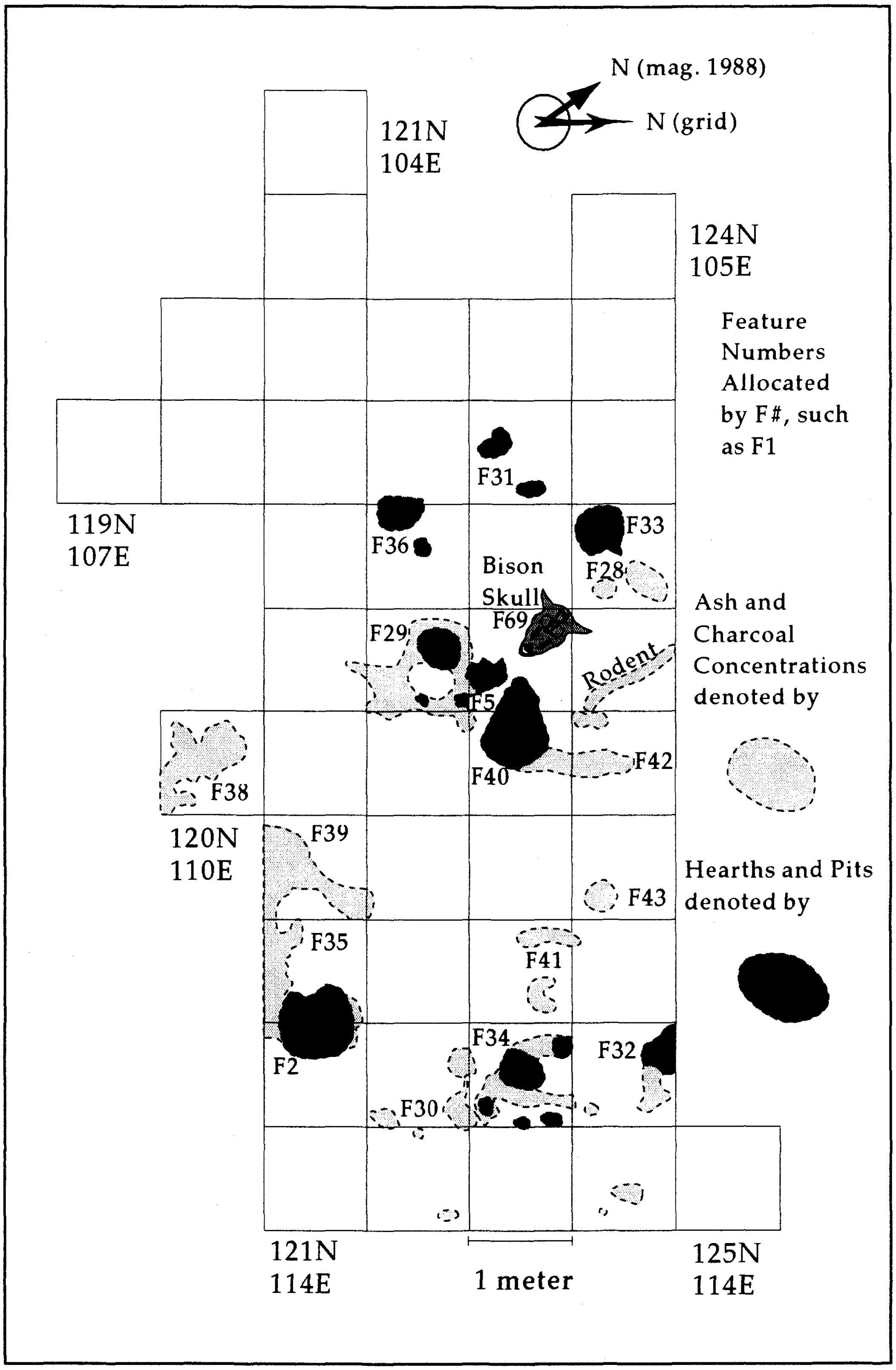


Figure 7.6 Layer 10 and 11 Features at the Redtail Site (FbNp-10)

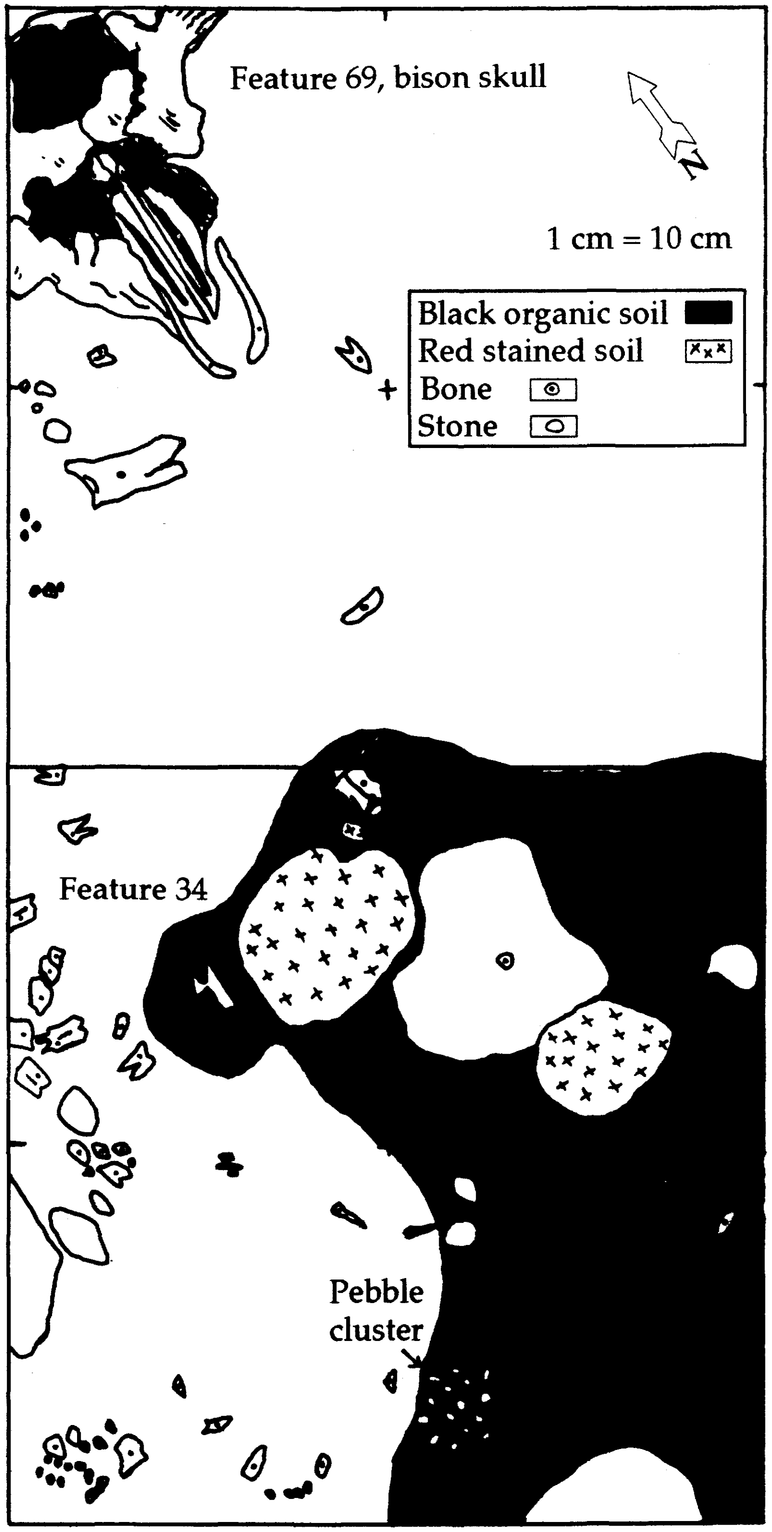


Figure 7.7 Feature 34, surface hearth complex, and Feature 69, bison skull

facing south-southeast (see Figure 7.7). The base of the skull is broken and the maxilla and upper teeth are scattered about in the same unit and adjacent units. An interesting aspect of this bison skull was the placement of two sets (i.e.: representing two individuals) of complete nasal bones, one set immediately above the other in anatomical placement with the rest of the skull. Other bison cervical vertebrae, limb bones, carpals, tarsals and phalanges are nearby. Within a metre to the west, some rib fragments are clustered in a pile. A few canid bones are also scattered with these predominantly bison remains.

Layer 11

In layer 11, sixteen features are identified (Table 7.1). These include eight hearths and eight charcoal concentrations (Figure 7.6). Three main spatial clusters of features are observed. The first of these extends south to north roughly from unit 122N 109E to 124N 108E and east to west from 123N 110E to 123N 107E. This appears to be a cluster of features in an area about 3.5 metres in diameter, roughly round and located on the most level portion of the slope within the block area (see Figure 4.4).

This first cluster includes features 5, 28, 31, 33, 36, 40 and 42. Six of these are hearths and two are charcoal concentrations. Feature 31 also includes two hearths (Figure 7.6). One hearth is elongated (25 cm by 13 cm) and the other is round (20 cm diameter). Fire-broken rock, bone and burned bone are associated with these hearths. Feature 33 is a larger (50 cm by 50 cm) shallow (4 cm) hearth which contained fire-broken rock, a nearly complete bison femur and other tarsal bones, in addition to charcoal-stained soil. Associated with this hearth is a large (50 cm by 50 cm), thin (2 cm thick) charcoal concentration, feature 28, which contains bone fragments. Another double hearth, feature 36, includes a larger (40 cm by 15 cm) and a smaller (18 cm by 17 cm) shallow (5 cm thick) hearth. The hearths are primarily ash-filled with charcoal-stained soil and fire-broken rock.

A large hearth, feature 40, is also present in this cluster (Figure 7.8). This hearth is 8 cm to 10 cm deep and about 65 cm in diameter. It is closely associated with another smaller (34 cm by 32 cm by 5 cm) hearth, feature 5 (Figure 7.8). A charcoal concentration (110 cm by 33 cm), feature 42, is also associated with the large feature 40 hearth. Feature 42 is an associated concentration of ash to the northwest of feature 40 (Figure 7.6).

The second cluster of features in layer 11 extends through units 120N 110E, 121N 111E and 121N 112E. This includes three large charcoal concentrations and one basin hearth. The basin hearth, feature 2, is 50 cm to 60 cm in diameter and 15 cm deep (Figure 7.9). It is associated with burned bone, bone, ochre and charcoal. Adjacent associations with this hearth also include a continuum of debris designated as features 35 and 39. These charcoal ash-stained and organic-stained soil concentrations are filled with burned bone and bone fragments as well as a lot of FBR. Feature 38 is also a charcoal and ash-stained soil with fire-broken rock (Figure 7.6) and is likely part of this same concentration of debris. These interconnected features appear to be a midden area.

A third concentration of features in layer 11 is shown in Figure 7.6 located in units 122N 113E, 123N 113E, 124N 113E and 123N 113E. Unit 124N 111E also has a feature and may be connected to this latter grouping by a rock concentration in 124N 112E. This grouping includes features 30, 32, 34, 41 and 43. Central to this cluster is feature 34, which includes a large surface hearth (nearly 40 cm in diameter and 4 cm thick) surrounded by a smaller hearth (33 cm by 17 cm) and four small concentrations of charcoal-stained soil. A charcoal concentration to the southwest of the hearth is about 8 cm in diameter and 3.5 cm deep. Two other small charcoal concentrations are located in the southeastern quadrant of 124N 113E and on the center of the west wall of unit 122N 114E.

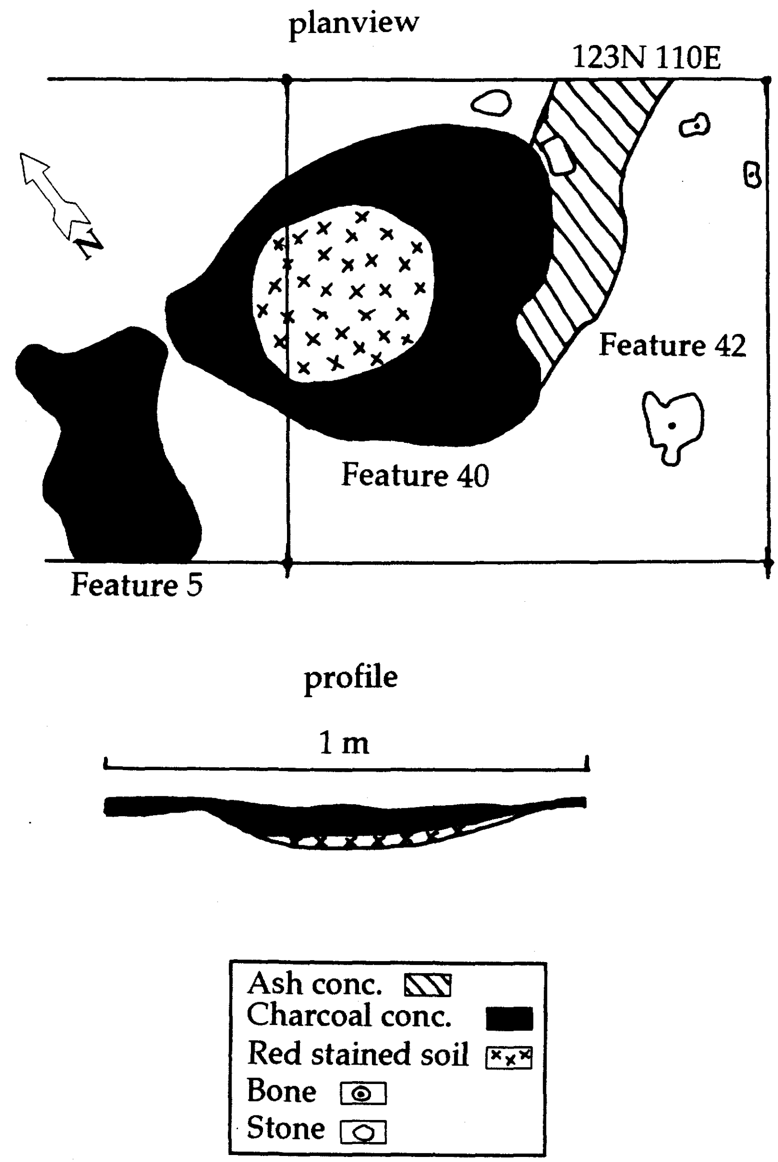


Figure 7.8 Feature 40, hearth planview and profile

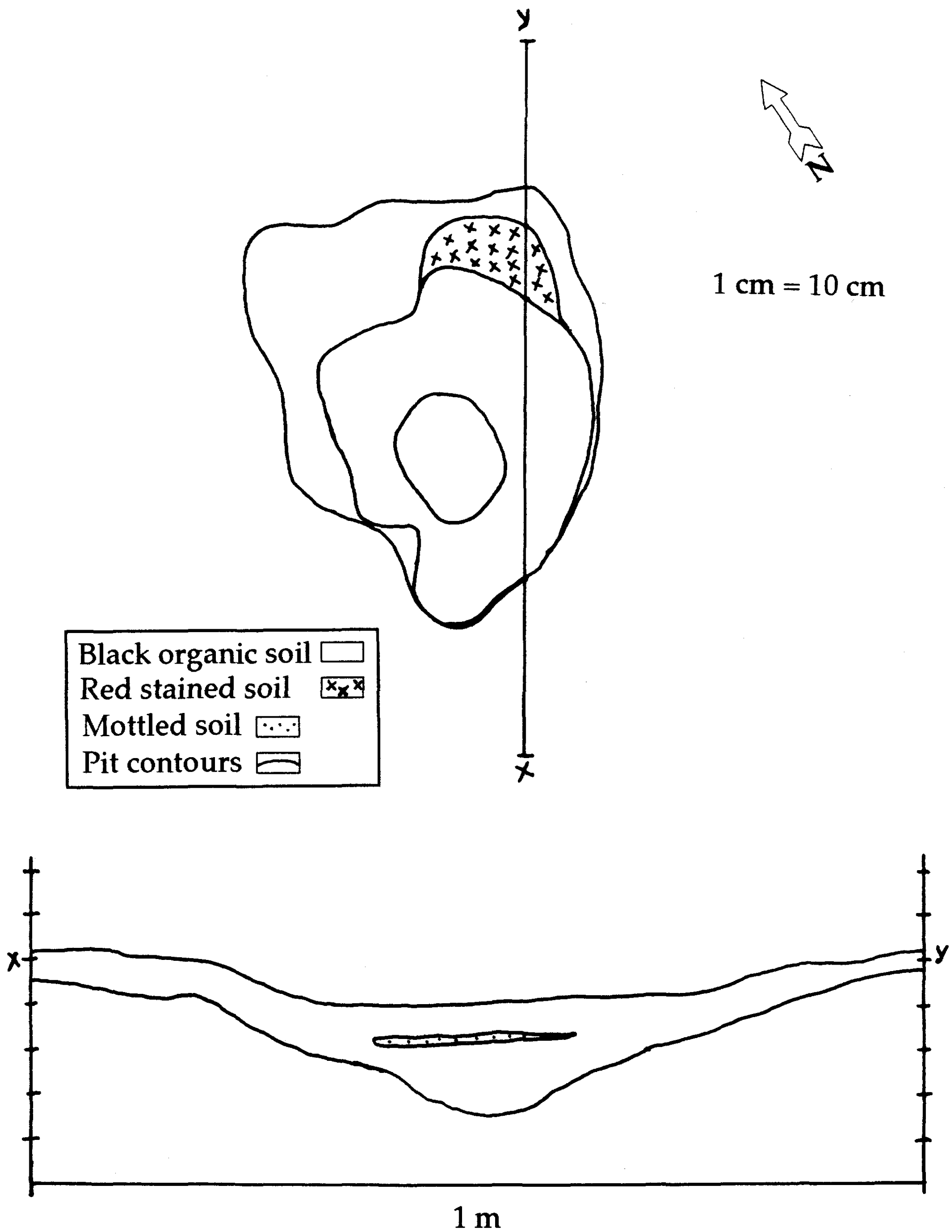


Figure 7.9 Feature 2, basin hearth planview and profile

Other concentrations are less well defined and contain some fire-reddened soil. Immediately to the south of this is feature 30, a group of three charcoal-stained soil concentrations. One contains fire-broken and unbroken rocks, another contains bone fragments. These are likely the result of debris removed from the feature 34 hearth. Charcoal feature 41 is C-shaped, and is concentrated just to the west. It too may be related to debris from feature 34. A cluster of bones and teeth is associated nearby.

Another surface hearth, feature 32, is located about one metre to the north of the feature 34 hearth. This hearth is about 30 cm in diameter and is associated with a smaller (20 cm by 16 cm) charcoal concentration located immediately downslope. Near this charcoal concentration is a set of two complete and two partial bison phalanges with unfused epiphyses and four sesamoids. Another charcoal stain, feature 43 in unit 124N 111E, is 20 cm by 22 cm in diameter and 4 cm thick.

Layer 12

Layer 12 contains sixteen features (Table 7.1). These include nine charcoal concentrations, five hearths and two pit features. Most of these features are in a 4.75 m by 3.5 m oval cluster (Figure 7.10). A lot of rock, FBR, chipped stone concentrations and bone are in this area. This may represent an outline of a temporary habitation structure, such as a tipi.

The cluster includes all six hearths at this layer, features 44, 47, 49, 50, 52 and 53. Feature 44 is 25 cm by 26 cm in area and 7 cm thick (Figure 7.11). A concentration of charcoal, feature 45, is associated to the west and this is intermixed with a jumble of FBR, rock and bone fragments. Feature 47 is a hearth about 36 cm by 30 cm and 9 cm deep (Figure 7.11). An ash concentration (feature 48) extends east and southeast downslope from hearth 47.

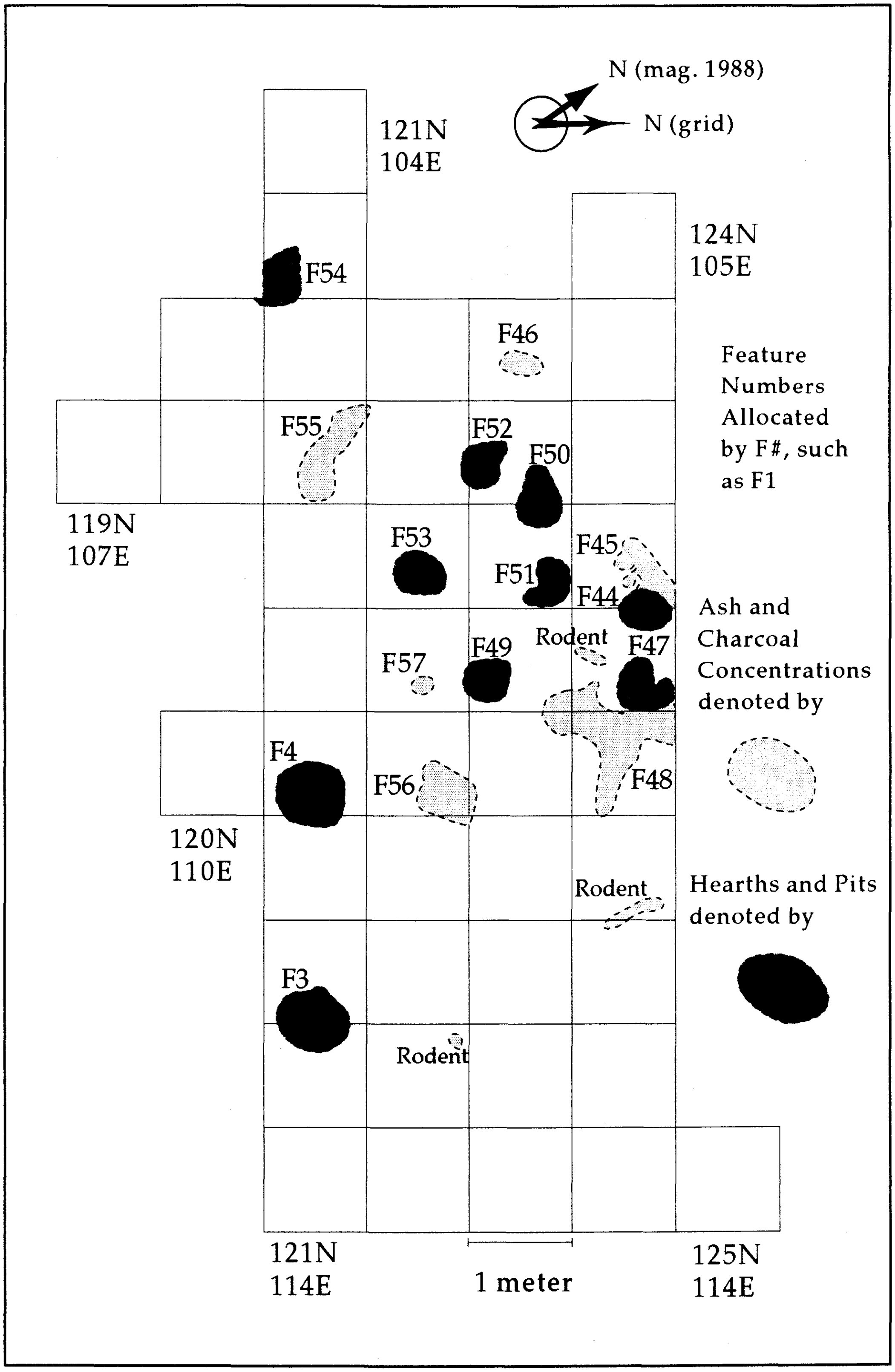


Figure 7.10 Layer 12 Features at the Redtail Site (FbNp-10)

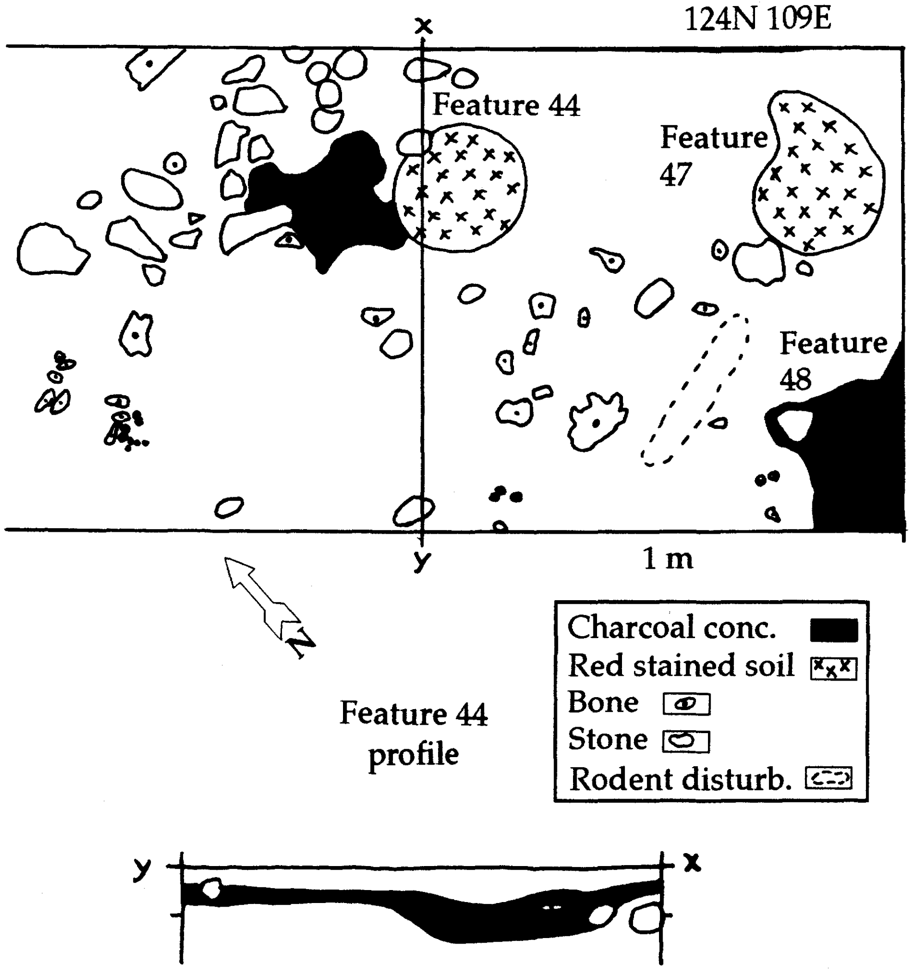


Figure 7.11 Feature 44 and 47, surface hearths planview and associations

(Figure 7.10). This feature contains FBR, rock and bone fragments. Another hearth, feature 49, is about 30 cm in diameter and 3 cm thick and contains FBR. It is surrounded by a number of bone fragments and chipped lithic debris. Hearth feature 50 is oblong-shaped (27 cm by 36 cm) and 5 cm to 8 cm deep. It contained a lot of charcoal, including stem portions. Feature 52 is a shallow (3 cm thick) hearth about 30 cm in diameter that contained burned bone. FBR, other rock, bone and flaked stone is nearby. Feature 53 is a surface hearth (3 cm thick) that is 30 cm by 35 cm in area. It appears to have been a center of lithic chipping activity, as it is surrounded by stone debris. Several rocks, some fire-broken and other chunks of hematite or limonite are in the immediate vicinity of the hearth. Feature 55 is about one metre southwest of the hearth. It consisted of a relatively large concentration of charcoal, bone, burned bone, rocks and FBR. Feature 57 is a small (12 cm diameter) charcoal concentration about 2 cm thick. Feature 51 is approximately central to this feature cluster (Figure 7.10). It is 30 cm by 37 cm and 5 cm deep. A few sporadic rocks and some bone fragments make up the sparse associations.

Some charcoal concentrations occur upslope (west end of the block). These include feature 46 which is a thin (2 cm thick) small area (17 cm by 16 cm) that contained bone fragments. Nearby, a few rocks and FBR are present. Farther upslope and to the south is another thin (2 cm thick) but larger (50 cm by 45 cm) charcoal-stained soil area, feature 54. It contains some bone and a few rocks.

Immediately downslope from the large cluster of features (the possible temporary structure outline) is a charcoal concentration, feature 56, containing FBR, rock and flakes (Figure 7.10). It is about 3 cm thick and covers at least 40 cm by 55 cm in area. Nearby, a red ochre stain and several bone fragments, as well as chipped lithic concentrations were found. Two other basin hearth/pit features occur downslope of this mid-block cluster.

Feature 4 is a large pit, 52 cm by 55 cm, and 14 cm deep (Figure 7.12). It has a considerable amount of rock and FBR clustered to the south and east. A lot of bone, several stone flakes and tools are also associated within or found nearby. The other pit/hearth is to the east of this first pit. This pit/hearth, feature 3, covers an area 30 cm by 40 cm and is 11 cm deep (Figure 7.13). It contains red ochre pieces and bone, and has red stains along one edge of the pit. Some of these stains were splotchy which may suggest red ochre paint stains as opposed to oxidation of the soil. The adjacent occupation layer contains a few bone fragments, a pebble chert flake and some FBR.

Layer 13

Layer 13 contains thirteen features, including seven hearths, five charcoal concentrations and a pit (see Table 7.1). They are positioned throughout the eastern half of the block excavation (Figure 7.14). Sublayers tend to be better separated in the east half of the block and thus features in this part were more easily separated to sublayer provenience.

Layer 13(1)

Five features are located in layer 13(1). These include two hearths, a pit and two charcoal stains. A charcoal concentration, feature 63, is about 30 cm by 35 cm, and 4 cm thick. Feature 63 has associations of a flake, bones and some rocks.

Feature 65 is a hearth located upslope (Figure 7.14). It is 30 cm by at least 15 cm in diameter and about 10 cm deep. Nearby associations include bone and FBR. Another mid-block feature, # 58, is a small charcoal concentration in unit 120N 110E. It is 20 cm by at least 32 cm and 5 cm thick. Nearby were bone fragments, flakes and several rocks, some fire-broken.

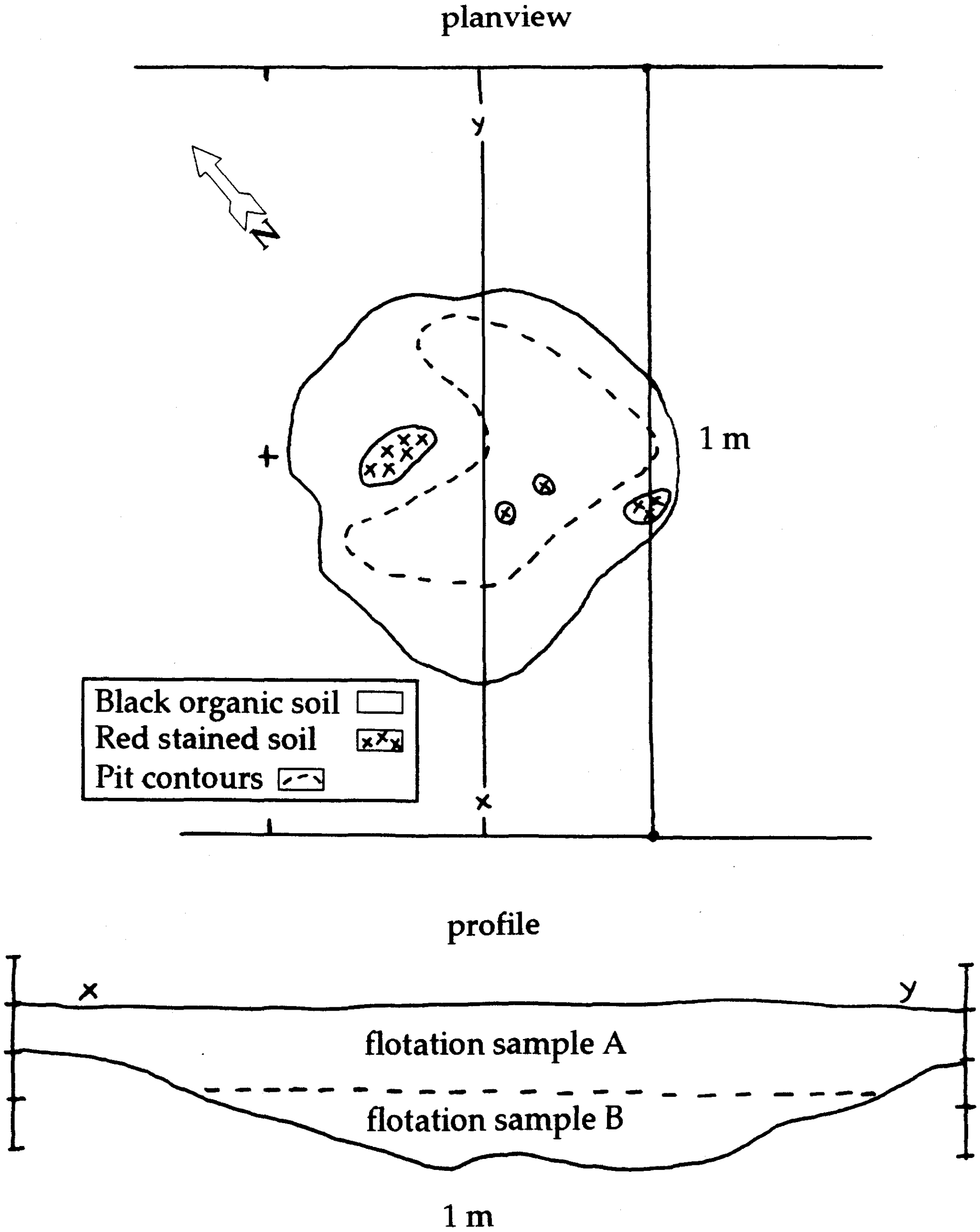


Figure 7.12 Feature 4, pit planview and profile

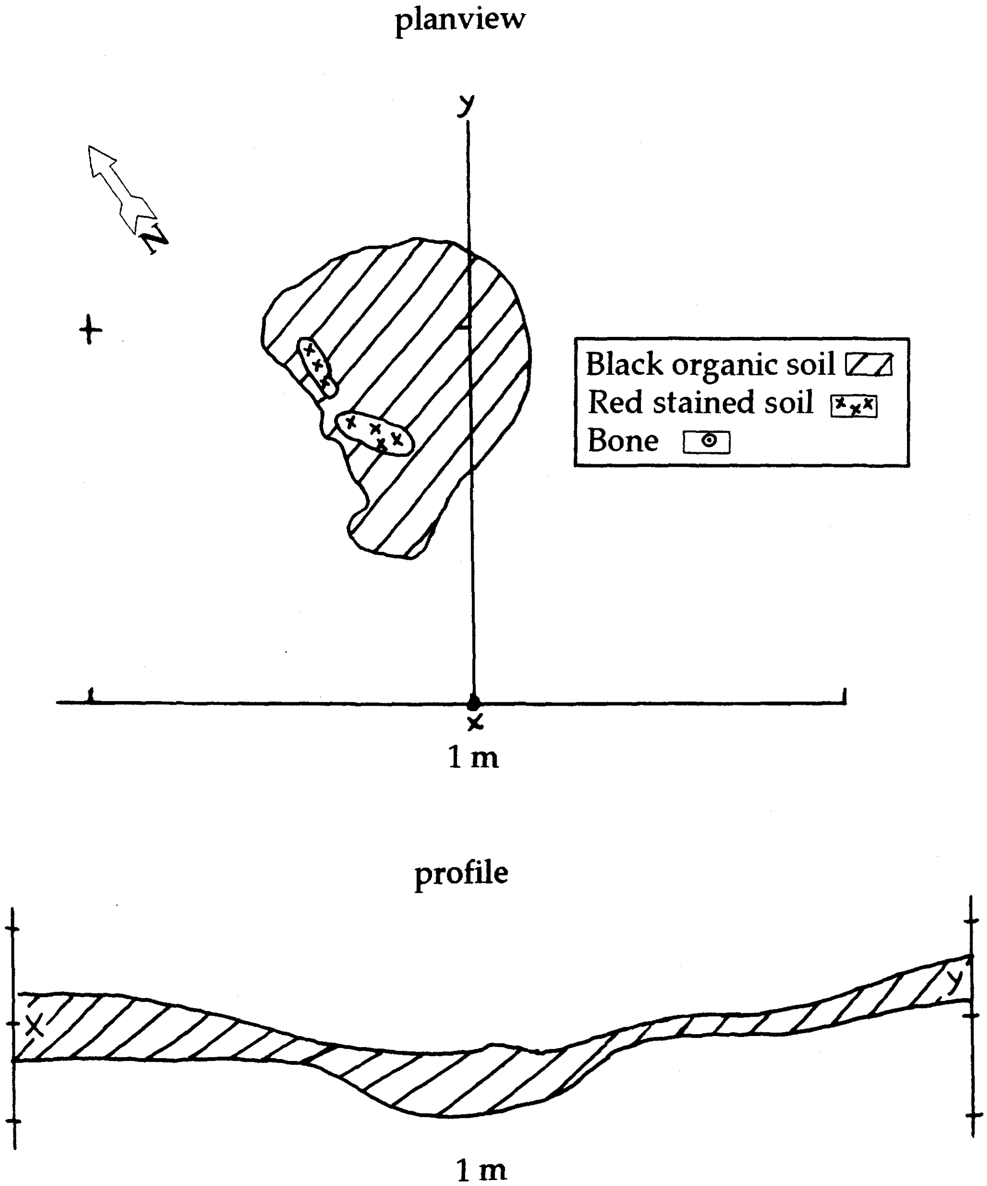


Figure 7.13 Feature 3, basin hearth planview and profile

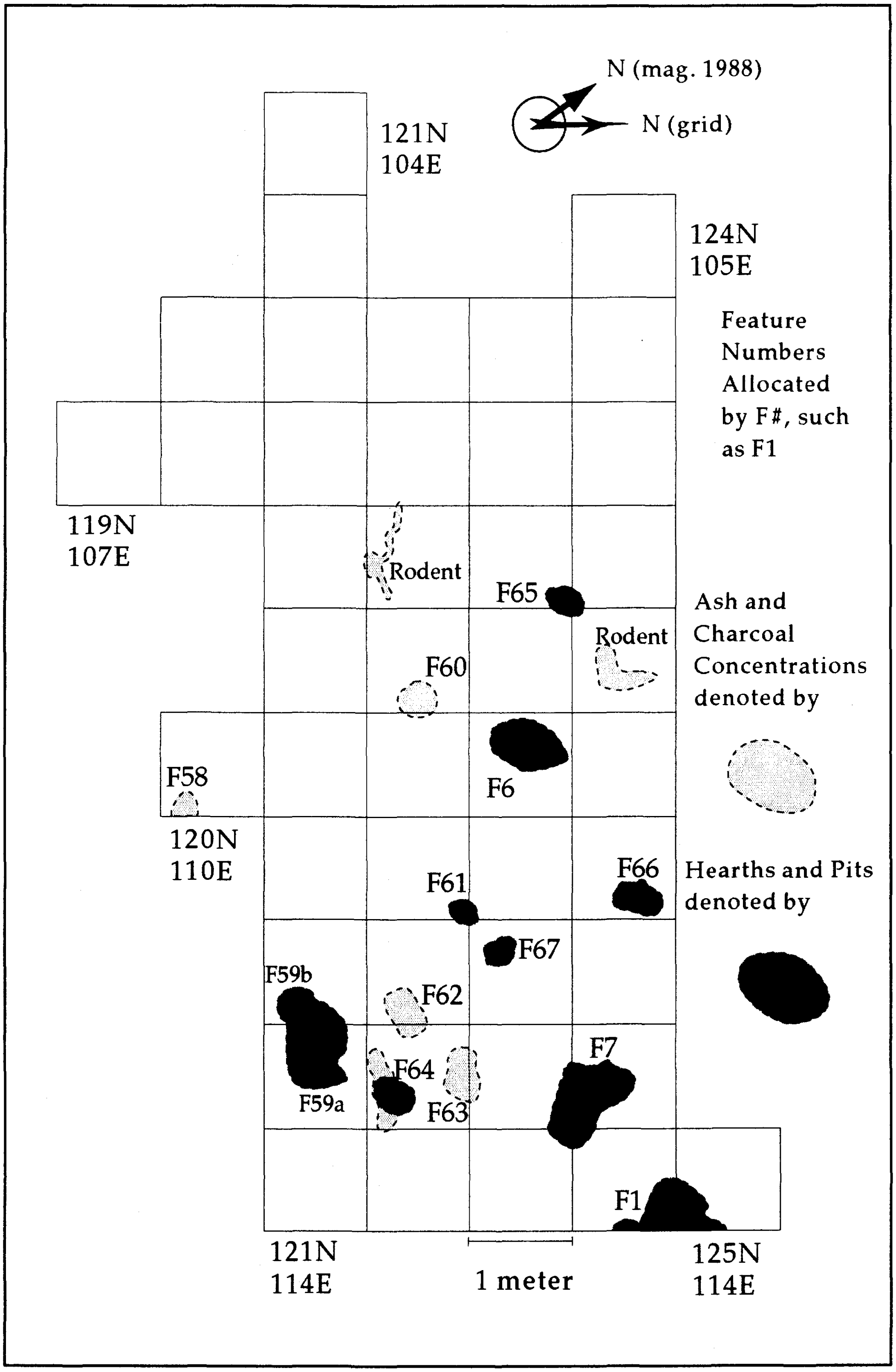


Figure 7.14 Layer 13 Features at the Redtail Site (FbNp-10)

A small surface hearth, feature 67, was 40 cm by 34 cm in area and contained five smaller oxidized stains at the base of its 2 cm depth. A few pieces of bone are nearby (Figure 7.15). A pit, feature 66, is about 115 cm to the north of this hearth. This pit is about 33 by 25 cm at the top and at least 15 to 20 cm deep (Figure 7.16). A bison ulna portion was stuck upright in the center of this pit and a large rock was on top of the pit. Thus, the top portion was partially excavated before it was recognized. Other materials in the pit include several bone fragments, including rodent remains, and FBR. Several rocks are to the east and southeast of this pit and a number of bone fragments are scattered about the feature. This feature may have been used for animal processing and then filled with debris, or perhaps it was used as a cache pit.

Layer 13(2)

In layer 13(2) five features are recognized. Farthest downslope, feature 1 is a hearth about 60 cm by at least 46 cm in area and 6 cm thick (Figure 7.17). It has a thick ash layer immediately above a 2 cm to 3 cm thick, red, oxidized soil. Several bone fragments, including rabbit bones, and some chipped lithic materials were around the hearth. A Duncan type point base was about 30 cm from the hearth's south edge, and another McKean Lanceolate point base was another 50 cm farther south. Nearby, feature 7(E) is a large, irregularly shaped hearth about 70 cm in diameter and 6 cm thick (Figure 7.17). An endscraper, a concentration of burned bone and flakes were found in this hearth.

Feature 59a is a surface hearth 67 cm by 75 cm in area and 5 cm deep (Figure 7.18). A few small red oxidized areas were about its edges. Within the feature are charcoal, bone, fire-broken rock and a small red stain. A large portion of a burned log was uncovered to the northeast of the feature. The log was over 30 cm long by 12 cm across. Feature 62 is a concentration of charcoal and ash with some FBR. It is thin (2 cm thick) and spread out in a 30 cm by 35 cm oval. It

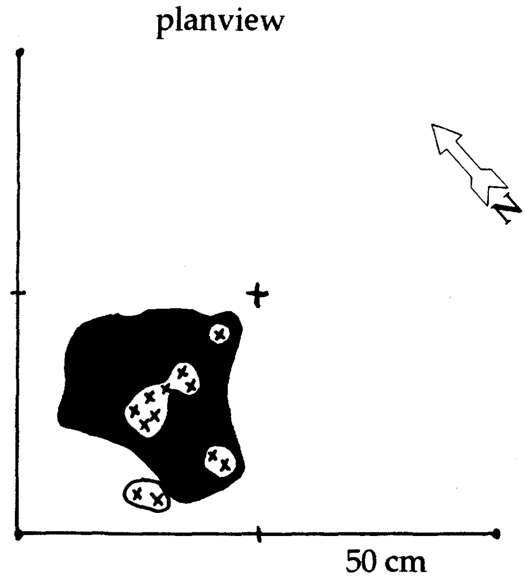


Figure 7.15 Feature 67, surface hearth planview

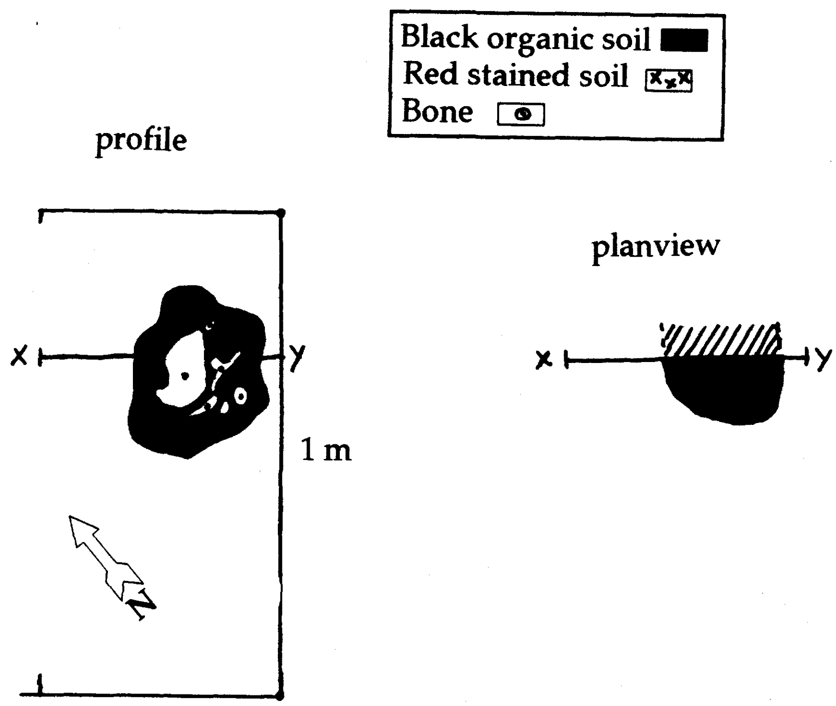


Figure 7.16 Feature 66, pit feature planview and profile

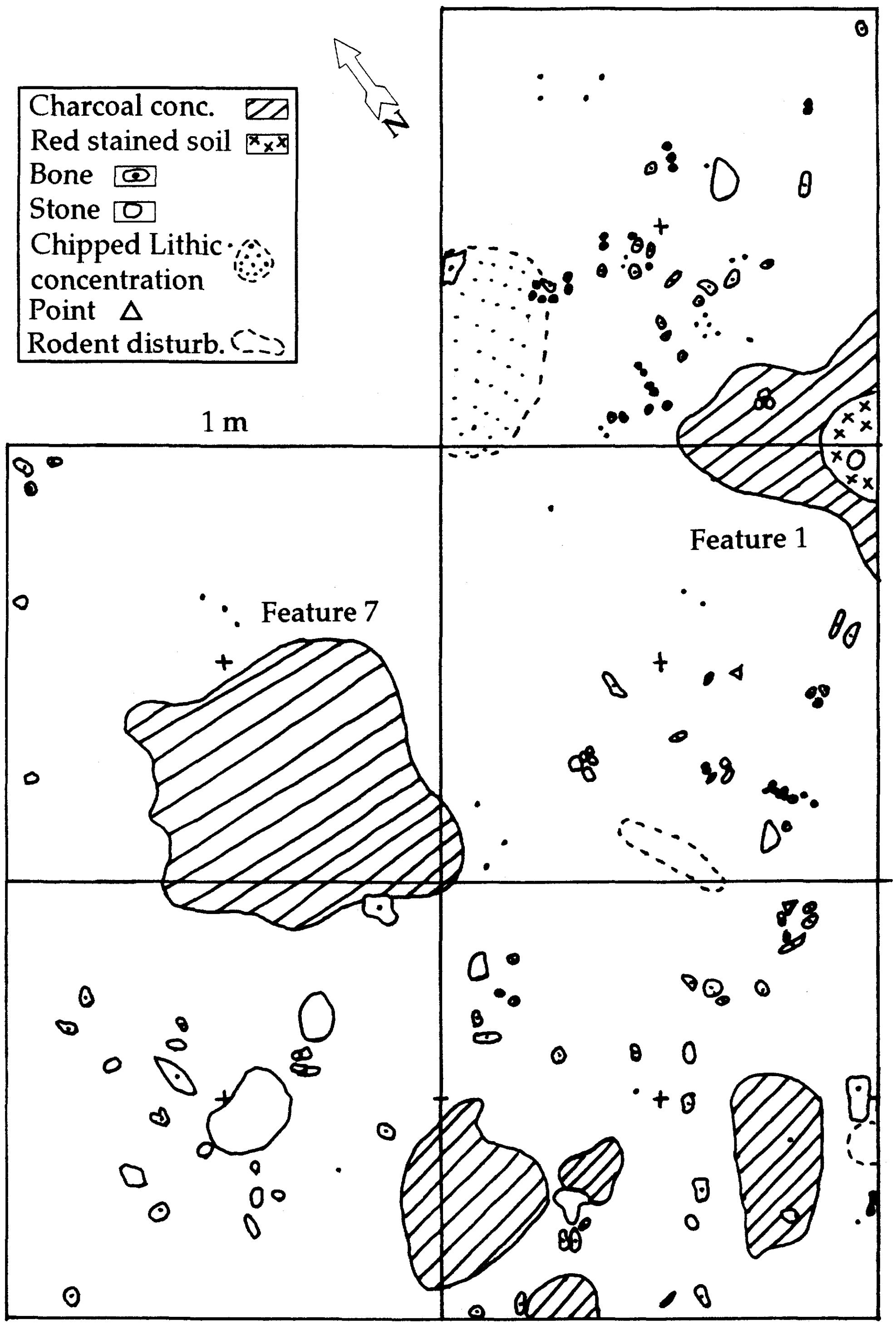


Figure 7.17 Features 1 and 7 planviews and associated mapped items

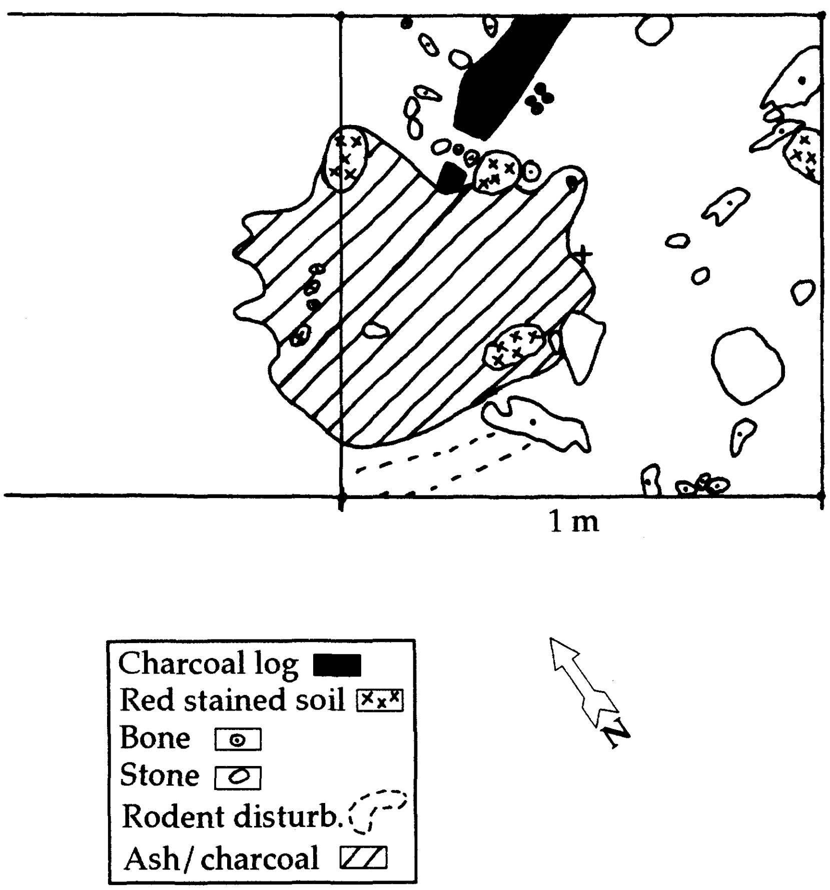


Figure 7.18 Feature 59a, hearth planview and associations

may be associated with refuse from the nearby basin hearth, feature 59a. Upslope, feature 60 is an ash and charcoal-stained soil concentration that has some associated flakes, bone and nearby fire-broken rock.

Layer 13(3)

Feature 59b, in units 121N 112E and 121N 113E, is a hearth 60 cm by 65 cm in area and 3 cm to 5 cm deep (Figure 7.14). It is immediately below feature 59a of layer 13(2) and was initially considered part of feature 59b. However, after some examination of profiles, depth measurements and mapped associations in layer 13(3) it has been denoted as a separate feature. Some large bone portions nearby include a distal end of a humerus and other long bone fragments. Several pieces of reduced FBR are also about the hearth.

Layer 13(4)

A small hearth, feature 61, is about 13 by 25 cm in area and 3 cm thick. Bone and some FBR are associated nearby. Another small hearth, feature 64, has two concentrations of charcoal-stained soil associated with it. This feature contains many bone fragments and some FBR (Figure 7.14).

Farther upslope, a large hearth (feature 6) is 75 cm by 60 cm in area and about 5 cm thick. It has an associated charcoal concentration (Figure 7.14). This hearth also has FBR and unbroken rock scattered about its margins, as well as several bone fragments.

Layer 14

There are no interpretive features noted for this layer. However, two mapped artifact areas include concentrations of small bone fragments with associated rocks. Both of these occur in layer 14(2). One of these is in the northwest quadrant of unit 122N 114E. It is a cluster of bone fragments about 30 cm by 40 cm in area associated with two larger cobbles, 18 cm by 10 cm and 10 cm by 12 cm, and a smaller cobble, 8 cm by 10 cm. The other feature is in the southern half of unit 124N 114E. It includes a concentration of unidentifiable bone fragments and some fragmented vertebrae in an area about 40 cm in diameter. Associated with this is a larger cobble (28 by 22 cm in size). Both these descriptive features suggest a bone reduction area utilizing the nearby rocks and perhaps other cobbles. There was no use-wear noted on these cobbles but limited use (as indicated by the discrete clusters of bone fragments) may not produce much observable wear.

Layer 15

Layer 15 did not have any interpretive features. Layer 15, however, does contain several cobbles but no pattern can be observed in the small area exposed.

7.4) Feature Flotation Analyses

Fifty flotation samples were collected from the Redtail site (FbNp-10) excavations in 1988 and 1989. Seven samples were submitted for analysis in the spring of 1992 (Table 7.2). The techniques used to process and analyze the samples is presented in the methodology section of this chapter. The following is the description of the recovered botanical and non-botanical remains as reported by Deck (1992). The contents of the flotation samples are summarized in Table 7.3.

Table 7.2 Redtail Site (FbNp-10) Flotation Samples

Sample Number	Unit	Quad	Layer	Depth (cm)	Description
G/2	121N 112E	NE/SE	11	112-121.5	Pit/Hearth
C/5	123N 109E	SE	11	116.5-119	Hearth
A/4&B/4	121N 110E	NE/SE	12	122-125	Pit
F/3	121N 112E	NE/SE	12	123.5-129.5	Hearth
E/7	124N 113E	SE	13	108.5-114	Hearth
D/6	123N 110E	NW	13	133.5-138	Hearth

After Deck (1992: 4)

Table 7.3 Summary of Contents of Flotation Samples from the Redtail Site (FbNp-10)

Sample Number	2/G	5/C	4/A	4/B	3/F	7/E	6/D
Layer	11	11	12	12	12	13(2)	13(4)
Feature Type	Basin Hearth	Hearth	Pit	Pit	Pit/Hearth	Hearth	Hearth
Residue (gm)	28	18.4	39.8	49.4	39.6	31.6	80.7
Flakes	0	0	11(0.37)	7(0.25)	0	1(0.11)	2(<0.01)
Bone Fragments	4(0.05)	212(1.79)	5(0.19)	28(0.45)	11(0.06)	42(0.67)	15(0.41)
Identifiable Bone	0	1(0.01)	0	0	3(0.03)	0	5(<0.01)
Calcine Bone	173(1.13)	50(0.15)	360(6.40)	649(9.41)	0	52(2.23)	26(0.26)
Shell Fragments	0	1	3	0	0	0	0
Shell Gastropod	0	0	2W 1F	4W	0	0	0
Ochre	4(0.16)	5(0.12)	7(0.18)	2(0.02)	1(<0.01)	8(0.18)	4(0.04)
Insect Remains	1F	1F	3F	0	0	0	2F
Fungal Sclerotia	0	X	X	0	0	0	X
Charcoal	51(0.39)	24(0.04)	97(0.83)	38(0.30)	4(<0.01)	4(<0.01)	2(0.03)
Charred Seeds	X	X	X	X	X	X	X

Quantities = number (grams)
W = Whole
F = Fragment
X = Present

From Deck (1992)

A total of 21 flakes were recovered from four samples. The pit feature (sample A-B/4) in layer 12 contains 18 of these while the two hearth features (sample E/7 and D/6) in level 13 contains three flakes (Deck 1992: 1-2).

Bone fragments were recovered from all seven samples. Calcined bone fragments were recovered from all samples except for the hearth feature sample (F/3) from layer 12. The majority of the bone fragments likely represent large-to medium-sized mammals. Four hearth samples contain identifiable bone. Hearth sample C/5 from layer 11 contains one toad or frog element. The pit/hearth sample G/2, also from layer 11 contains rodent incisor fragments. Hearth sample F/3 from layer 12 contains three toad or frog elements including a humerus and innominate. Hearth sample D/6 from layer 13 includes four toad or frog elements, a charred small mammal distal radius, and a large mammal tooth fragment (Deck 1992: 2).

Inspection of the "toad or frog" specimens, particularly in C/5 and D/6, indicates that they are small and more likely frog remains. The sample F/3 remains are slightly larger but without comparative samples they cannot be identified.

Shell remains were recovered from the hearth feature in layer 11 (sample C/5) and the pit feature (sample A-B/4) in layer 12. The hearth feature has one shell fragment represented while the pit feature has three shell fragments, six complete gastropods and one fragmented gastropod. The gastropods represent a minimum of two species (Deck 1992: 2).

All seven flotation samples contain ochre. The ochre includes both hematite and limonite. A small quantity of insect remains was recovered from four samples representing layers 11, 12 and 13. The insect remains appear to be mainly ant heads (Deck 1992: 2).

Joe Krieg also noted several ant remains in addition to other probably "recent" insect remains from a few fine-screen samples that he sorted (Krieg 1992, personal communication). This is undoubtedly due to insect infiltration of the soil through opened units while excavating.

Fungal sclerotia are solid black spheres commonly recovered during flotation and are often mistaken for seeds. "Sclerotia are formed by fungi that are parasitic on trees, shrubs and herbs" (Shay *et al*. 1991: 87). Three samples, from layers 11, 12 and 13, contain probable fungal sclerotia (Deck 1992: 2). In the field, and initially in the laboratory, these were thought to be wild hazel nut shells. The correct identification greatly alters any potential conclusions, and other researchers should be aware of this.

All seven samples yielded charcoal (Table 7.4). A total of 60 pieces were analyzed. The majority of the charcoal is represented by charred twigs and are charred to the degree that the specimens are unidentifiable. Taxa are listed below by occurrence or presence/absence within a sample to compensate for sampling biases. *Populus* occurs in three samples, cf.*Populus*/*Salix* in two, diffuse porous in six, semi-ring porous in two, hardwood in four, conifer in one and unidentifiable in six samples. Diffuse porous is represented by at least two types, Type I was cf. Rosaceae (Deck 1992: 2).

All seven samples have seed remains (Table 7.5). Seed density varies between samples from 0.5 to 17 seeds per litre (Table 7.6). Taxa include *Chenopodium, Potentilla, Prunus, Rosa, Symphoricarpos,* cf. Labiatae and cf. Compositae. Plant use and season availability are summarized in Table 7.7. The identified plant remains seem to represent resources that were exploited between the summer and early fall. The seed remains may be used, in conjunction with other evidence from the site, to interpret season of site occupation. However,

Table 7.4 Charcoal Remains from the Redtail Site (FbNp-10)

Sample Number	Layer	Feature Association	cf. Populus	cf. Populus/ Salix	Diffuse porous	Diffuse porous Type I	Diffuse porous Type II	Semi-ring porous	Hardwood	Conifer	Unident.	TOTAL
2/G*	11	Basin Hearth	1	1	5	4	0	1	8	0	5	25
5/C	11	Hearth	0	2	0	1	0	0	0	0	2	5
4/A	12	Pit	1	0	0	3	3	1	2	0	0	10
4/B	12	Pit	2	0	1	1	0	0	2	1	2	9
3/F	12	Pit/Hearth	0	0	0	0	0	0	0	0	4	4
7/E	13(2)	Hearth	0	0	2	0	0	0	1	0	1	4
6/D	13(4)	Hearth	0	0	2	0	0	0	0	0	1	3
TOTAL			4	3	10	9	3	2	13	1	15	60

* Includes 10 fragments from a subsample of charcoal collected with rodent teeth.

From Deck (1992)

Table 7.5 Charred Seed Remains from the Redtail Site (FbNp-10)

Sample Number	2/G	5/C	4/A	4/B	3/F	7/E	6/D	TOTAL
Layer	11	11	12	12	12	13(2)	13(4)	
Feature Type	Basin Hearth	Hearth	Pit	Pit	Pit/Hearth	Hearth	Hearth	
Chenopodium sp.	9W 2F	3W	3W	3W	0	0	5W 2F	23W 4F
Potentilla sp.	0	0	0	0	0	1W	0	1W
Prunus sp.	5F	0	0	0	0	1F	0	6F
Rosa sp.	2W 7F	0	0	0	0	0	3F	2W 10F
Symphoricarpos sp (seed)	1W	0	0	0	0	0	0	1W
Symphoricarpos sp (berries)	16F	0	0	0	0	0	0	16F
cf. Compositae	1W	0	0	0	0	0	0	1W
cf. Labiatae	0	1W	0	0	0	0	0	1W
cf. Iva sp.	0	0	0	0	0	1W	0	1W
nut shell	0	0	0	0	0	0	1F	1F
unidentified seeds	7W 134F	4F	0	0	1W	5F	10F	8W 153F
cf. bud	1F	0	0	0	0	0	0	1F
TOTAL	20W 165F	4W 4F	3W	3W	1W	2W 6F	5W 16F	38W 191F

W = Whole
F = Fragment(s)

From Deck (1992)

Table 7.6
Seed density/litre for flotation samples from Redtail Site

Sample	Layer	Sample Type	Litres of Soil*	Seed Quantity~	Density per litre
G/2	11	Pit/Hearth	2	102.5	51
C/5	11	Hearth	6	6	6
A/4	12	Pit	2	3	1.5
B/4	12	Pit	2	3	1.5
F/3	12	Hearth	2	1	0.5
E/7	13	Hearth	1.5	5	3
D/6	13	Hearth	2	13	6.5
TOTAL			17.5	133.5	8

* Approximation
~ Seed fragments were counted as 0.5.
After Deck (1992: 8)

plant remains could have been collected, saved and used over different seasons (Deck 1992: 2).

7.5) Plotted Patterns and Distributions

The previous sections have described feature relations and planview map associations. This section presents the distributions of three material culture categories: bone, chipped lithics and FBR. Frequencies of bone per unit and the presence of burned bone is the first set of distributions. The lithic frequency distributions show amounts of debitage in units, and locations of various stone tools. Bone tools are also included here. Frequencies of FBR are presented in another set of distributions with the charcoal samples. Larger charcoal samples (>100 pieces) are also noted. These samples indicate a presence of charcoal but the absence of charcoal in other units may be misleading, as most flotation samples incorporated charcoal. Each layer is discussed in sequence from layer 8 to layer 15.

Table 7.7 Plant Use and Seasonal Availability Based on Selected References

Scientific Name	Common Name	Part Used	Use	Season Available	Reference
Chenopodeaceae					
Chenopodium sp.	Goosefoot	greens, seeds	food	summer; late summer to early fall	Shay 1980 Densmore 1974
Rosaceae					
Potentilla sp.	Cinquefoil	roots & tubers	food	late summer to early fall	Shay 1980
Prunus sp.	Plum/Cherry	berries & fleshy fruit	food; medicine	late summer to early fall	Shay 1980; Zoltai 1989
Rosa sp.	Rose	flowers, berries & fleshy fruit	food, beverage, medicine	summer; late summer to early fall	Shay 1980; Densmore 1974; Zoltai 1989
Caprifoliaceae					
Symphoricarpos sp.	Snowberry		medicine		Densmore 1974
Labiatae	Mint Family	roots & tubers	food	late summer to early fall	Shay 1980
Compositae*	Composite	roots & tubers, greens, flowers, seeds	food, seasoning	spring; summer; late summer to early fall	Shay 1980

* The part used, use and season available depends on the species. Iva sp. is in the Composite Family.
From Deck (1992)

Layer 8

A map of the point provenienced materials from layer 8, including features, provides a visual perspective of most larger remains (Figure 7.19). Unburned and burned bone distributions are presented for layer 8 in Figure 7.20. The entire block is fairly completely covered by bone remains. This indicates some dispersion of remains by cultural and/or natural processes. Chipped lithic and tool distributions are more discrete (Figure 7.21). Fire-broken rock distributions are limited (Figure 7.22).

The concentration of features associated with the pithouse (Figure 7.19) is only moderately reflected by bone frequencies and the presence of burned bone (Figure 7.20). This may indicate that these features functioned more for heating or cooking food than for processing bone. Higher amounts of bone are located in the southeast corner of the block and this may be related to more animal processing activities. Chipped lithic materials, though present in the western half of the exposed pithouse, are primarily located to the southwest of this area within other feature loci. This may reflect messier knapping activities are located peripheral to the sleeping hollow or shallow pithouse. An anvil is located on the western margin of the pithouse and is likely associated with activities at feature 14. Charcoal samples were taken in units adjacent to the features, and much more charcoal is represented in flotation samples from the six features in this pithouse. It seems odd that FBR is not associated with this structure. Further excavation may reveal these materials are located to the north, more central to the structure. Perhaps lack of FBR reflects a warmer seasonality of occupation.

Most intense bone and burned bone concentrations are located in the southeast corner of the block area and are strongly associated with features 22, 23, 24, 27 and 26 (Figure 7.1). The first four of these features are associated with layer 8(1). This area seems to reflect more intense animal utilization and is likely

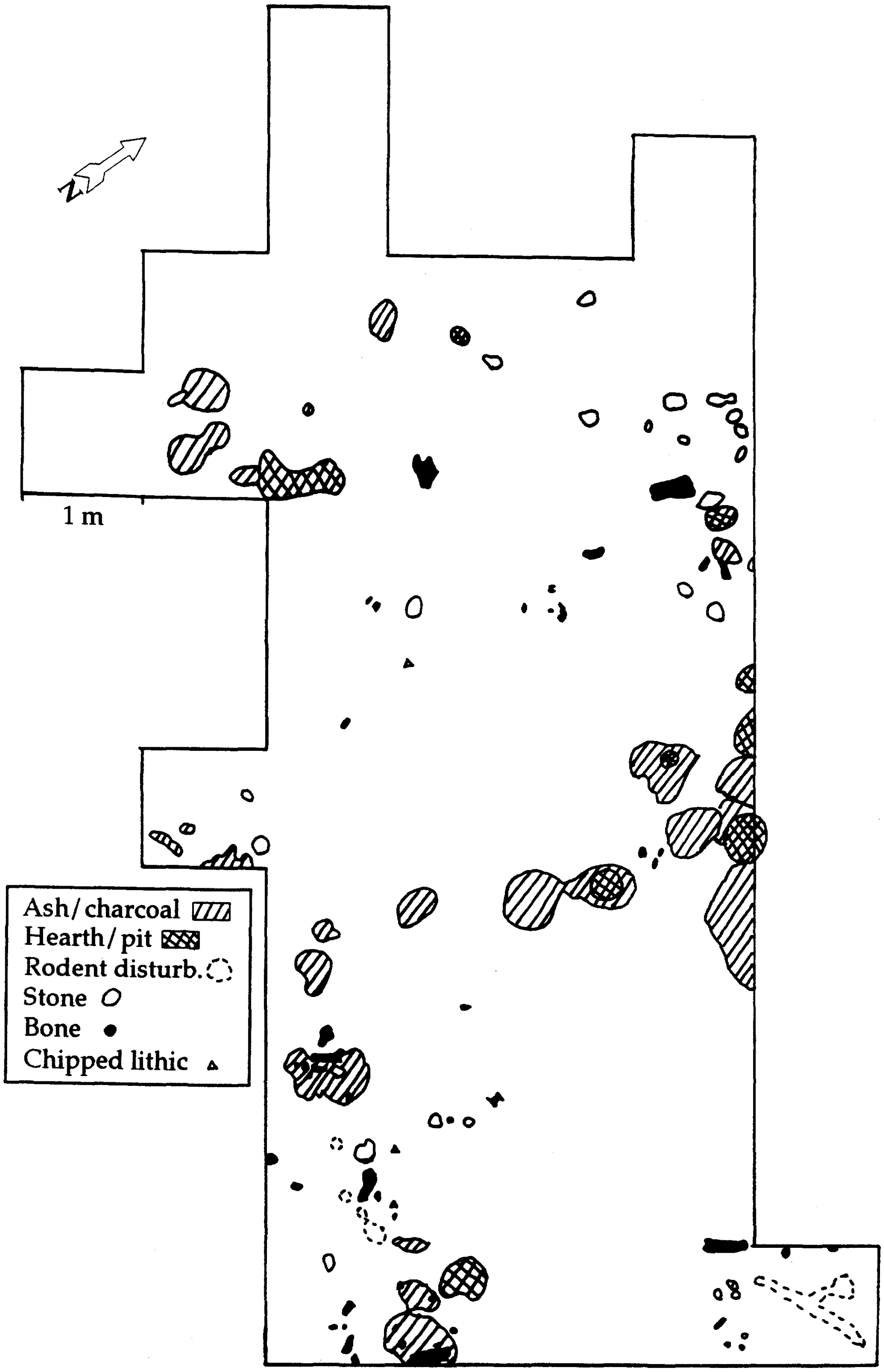


Figure 7.19 Layer 8 point provenienced materials

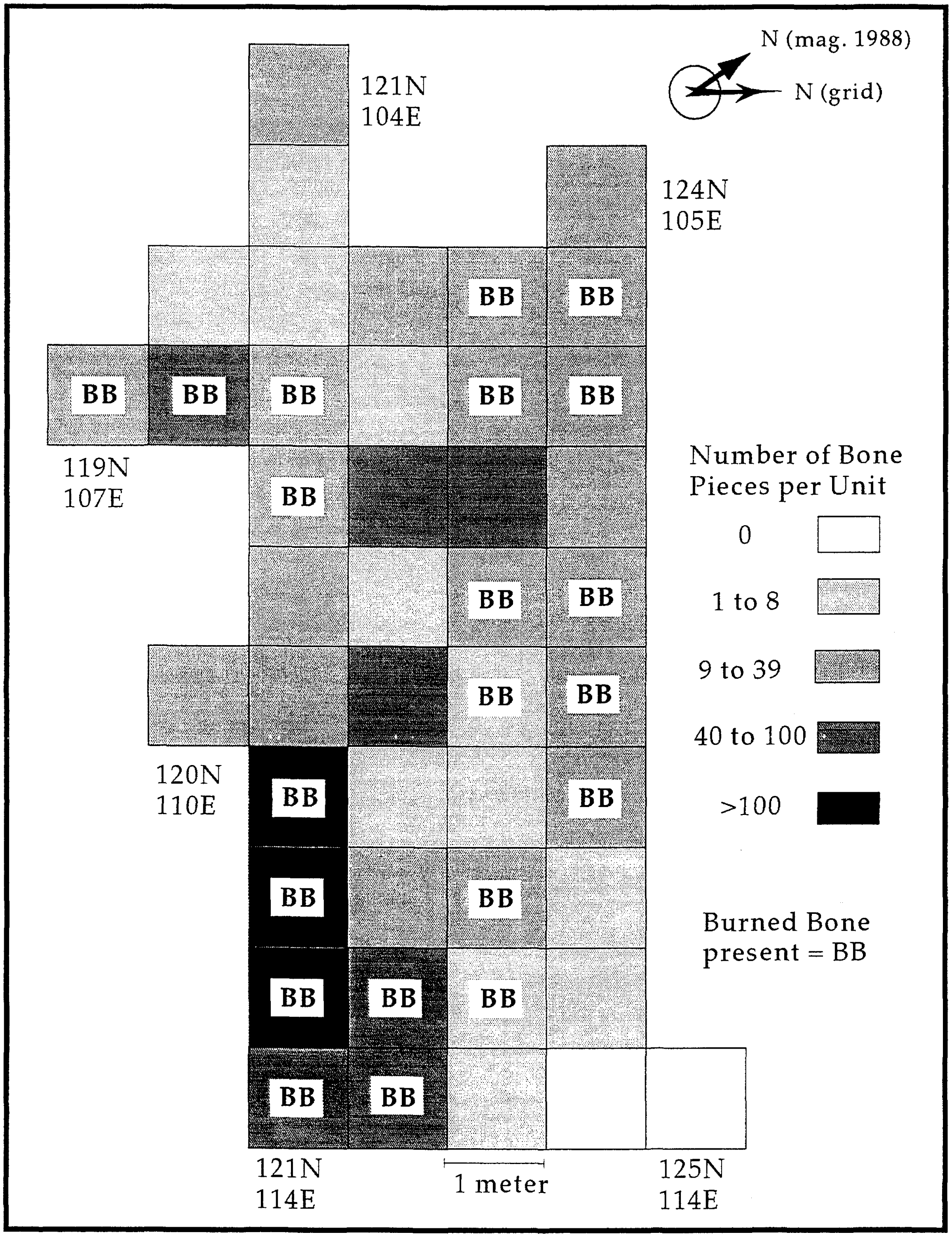


Figure 7.20 Layer 8 Unburned and Burned Bone Distributions

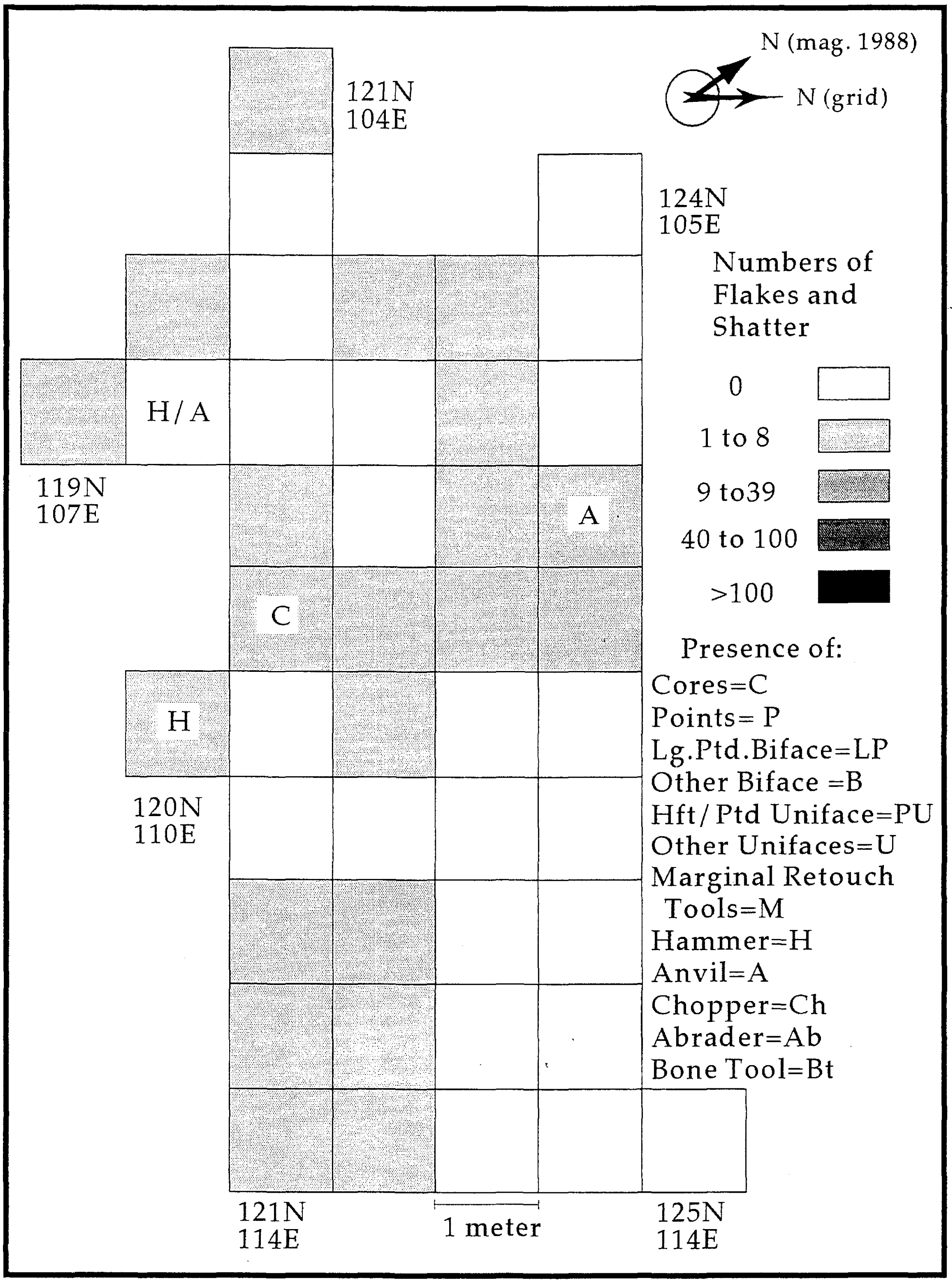


Figure 7.21 Layer 8 Lithic Debris and Tool Distributions

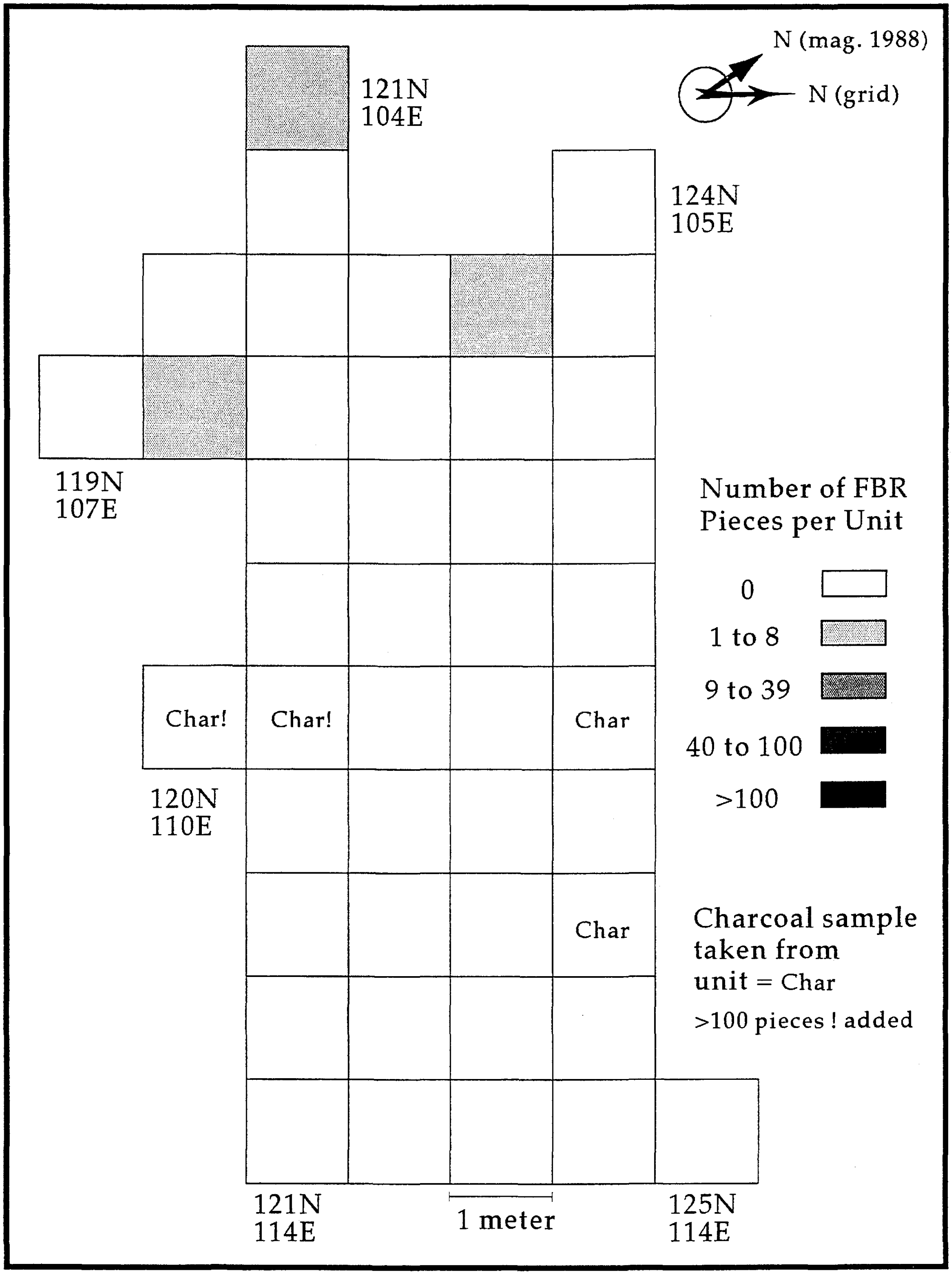


Figure 7.22 Layer 8 Fire-Broken Rock and Charcoal Distributions

a processing locus and subsequent midden area. However, no FBR is in this locus of activity. Some charcoal was noted while collecting flotation samples from the features. Chipped lithic materials are also associated with this area (Figure 7.21). Features 20 and 21 have a hammerstone associated with them as well as large charcoal samples. Chipped lithic materials in unit 121N 109E and some adjacent units are related to reduction of a bifacial SRC core.

Another cluster of features in layer 8(2) in the southwestern part of the block (numbers 17, 18, 19, 25 and 37) are associated with two clusters of burned bone and two corresponding areas of increased bone frequency. Features 18 and 25 are associated with chipped lithic debris and FBR. Features 17 and 37 are associated with a combination hammer and anvil tool which was also broken in a fire. Some FBR is also located in unit 121N 104E farthest upslope.

Layer 9

Bone debris in this layer is sparse and dispersed throughout most of the block. Three areas of moderate bone accumulation are observed and two of these areas correlate with the presence of burned bone (Figure 7.23). These two burned bone areas indicate the presence of hearths in the vicinity. Lithic distributions are sparse but indicate two main clusters of activity (Figure 7.24). They generally reflect the activity of core reduction. A single core appears associated with each chipped lithic concentration. FBR may provide the clues to locating the missing features mentioned above. The three bone clusters seem to correlate with four FBR clusters noted in Figure 7.25. The two smaller FBR clusters may represent use in one or two features but are associated with an increased amount of bone in the west end of the excavation block. A more substantial concentration of FBR in the center of the block correlates with increased bone frequency and the presence of burned bone. At the east end of the block a moderate amount of FBR is adjacent to concentrations of bone and burned bone that are just downslope. A

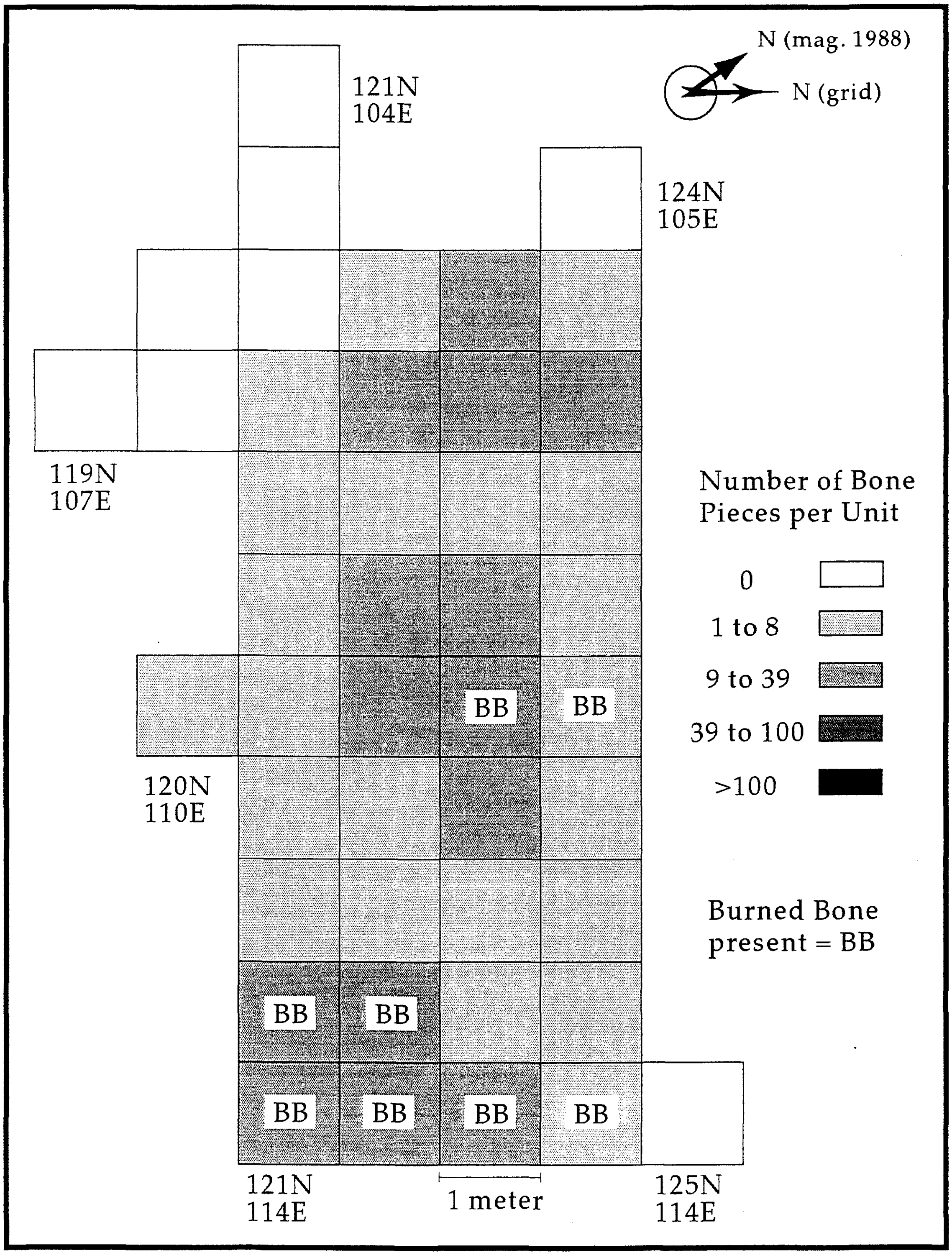


Figure 7.23 Layer 9 Unburned and Burned Bone Distributions

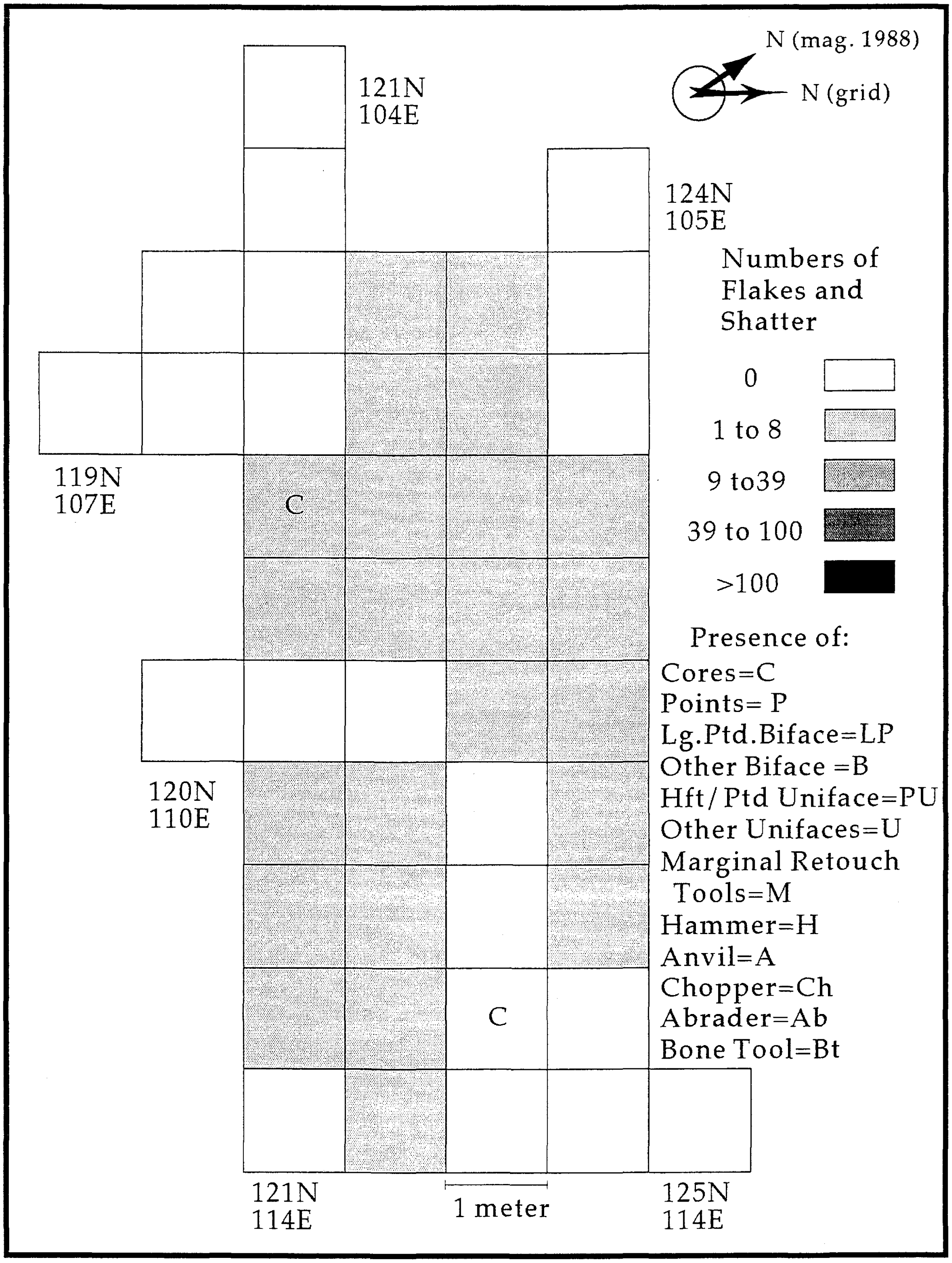


Figure 7.24 Layer 9 Lithic Debris and Tool Distributions

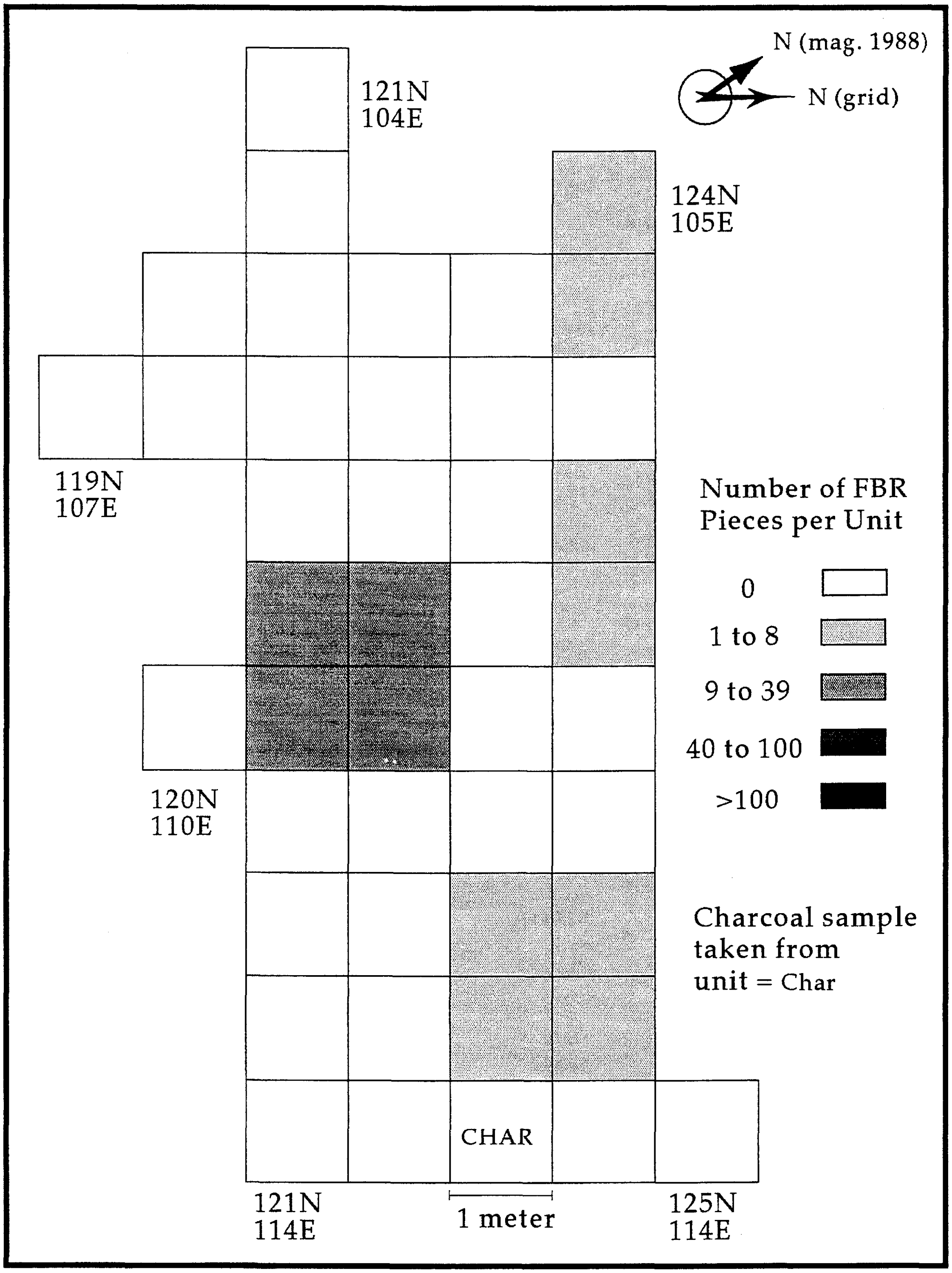


Figure 7.25 Layer 9 Fire-Broken Rock and Charcoal Distributions

charcoal sample is also noted downslope from this FBR concentration. This may suggest organic remnants of a slopewashed feature, with the FBR staying in place of the original feature's location.

Layer 10

A point provenience map of layers 10 and 11 shows the bison skull and the surface hearth feature about a metre to the south (Figure 7.26). Some adjacent bone and other materials are also depicted. These two layers are presented together primarily because during the catalogue transfer, "notes" were inadvertently missed. These "notes" had the correlating numbers between catalogued, layer corrected materials, and map numbers for point provenience. Thus, the separated mapped materials are not immediately available for presentation. This map, however, provides some sense of material patterning, which can be compared to the separate density plots of the layers.

A dense concentration of bone and burned bone is indicated in layer 10 centering on feature 29 and the bison skull (Figure 7.27). A small outlying cluster of bone is also noted in 123N 112E. Chipped lithic debris is evenly scattered in and about the features (Figure 7.28). A slight increase in these lithic materials is indicated in and adjacent to the feature 29 hearth. Two unifacial tools are also located adjacent to the hearth. One is a notched and pointed graver-like tool, and the other is a small scraper-like tool fragment. A core is located to the northwest of this feature. Fire-broken rock is represented in the hearth area and continues west to the block margins (Figure 7.29). A few other outlying FBR are present at the northeast corner of the block and south central margin. Charcoal samples were taken in and adjacent to the bison skull (feature 69). Some charcoal is also associated with the FBR in the northeast corner of the block.

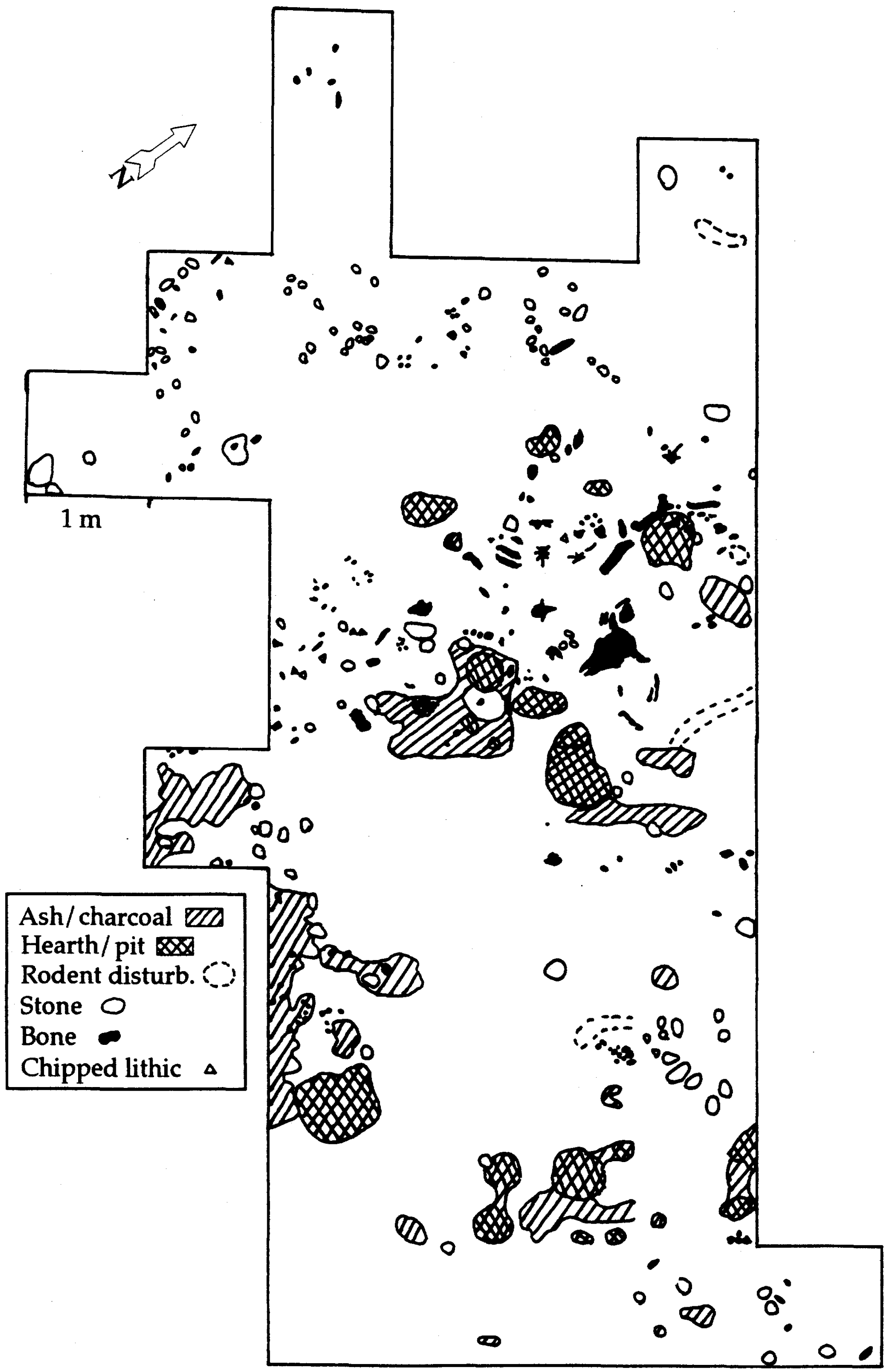


Figure 7.26 Layer 10 and 11 point provenienced materials

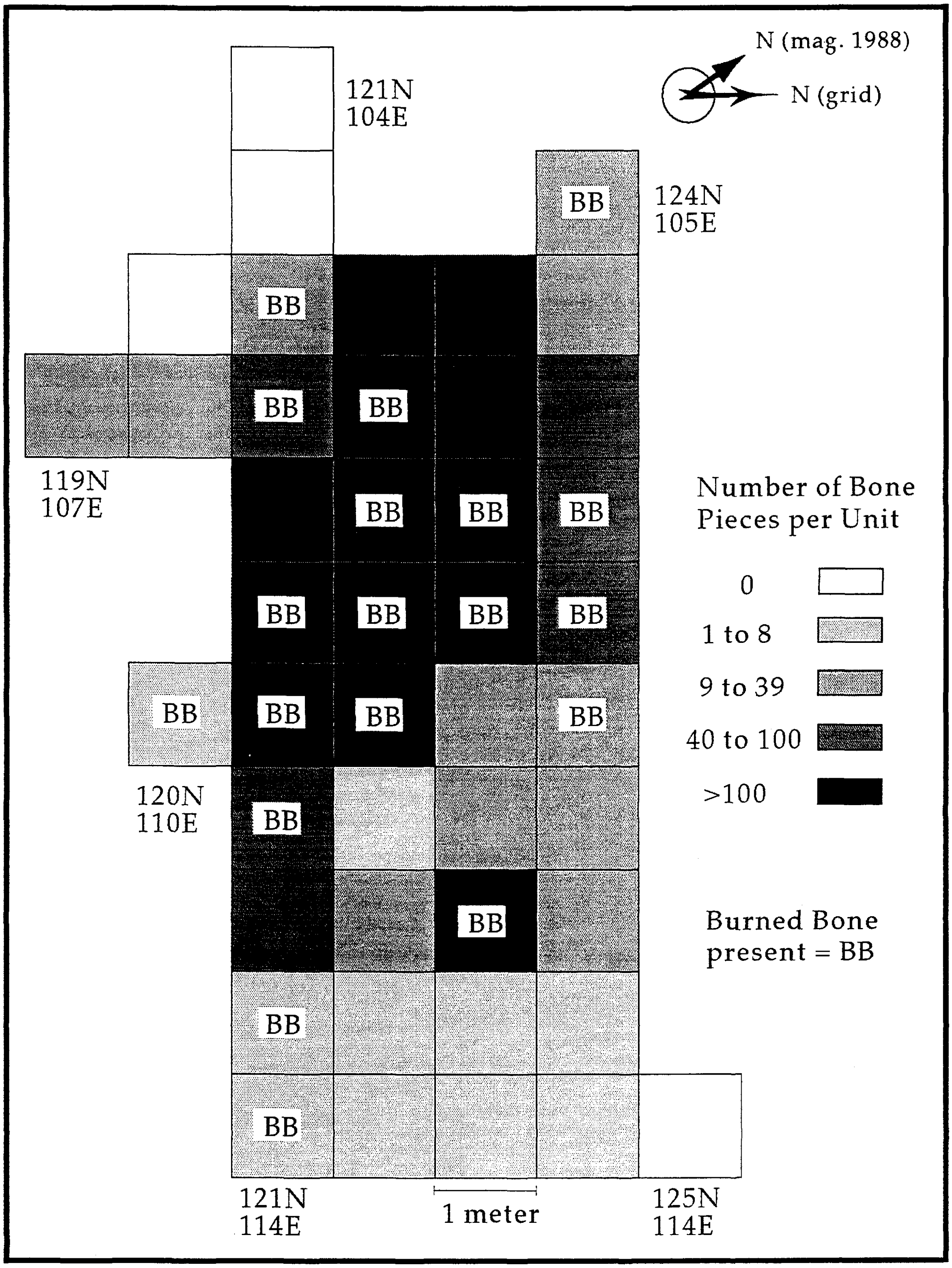


Figure 7.27 Layer 10 Unburned and Burned Bone Distributions

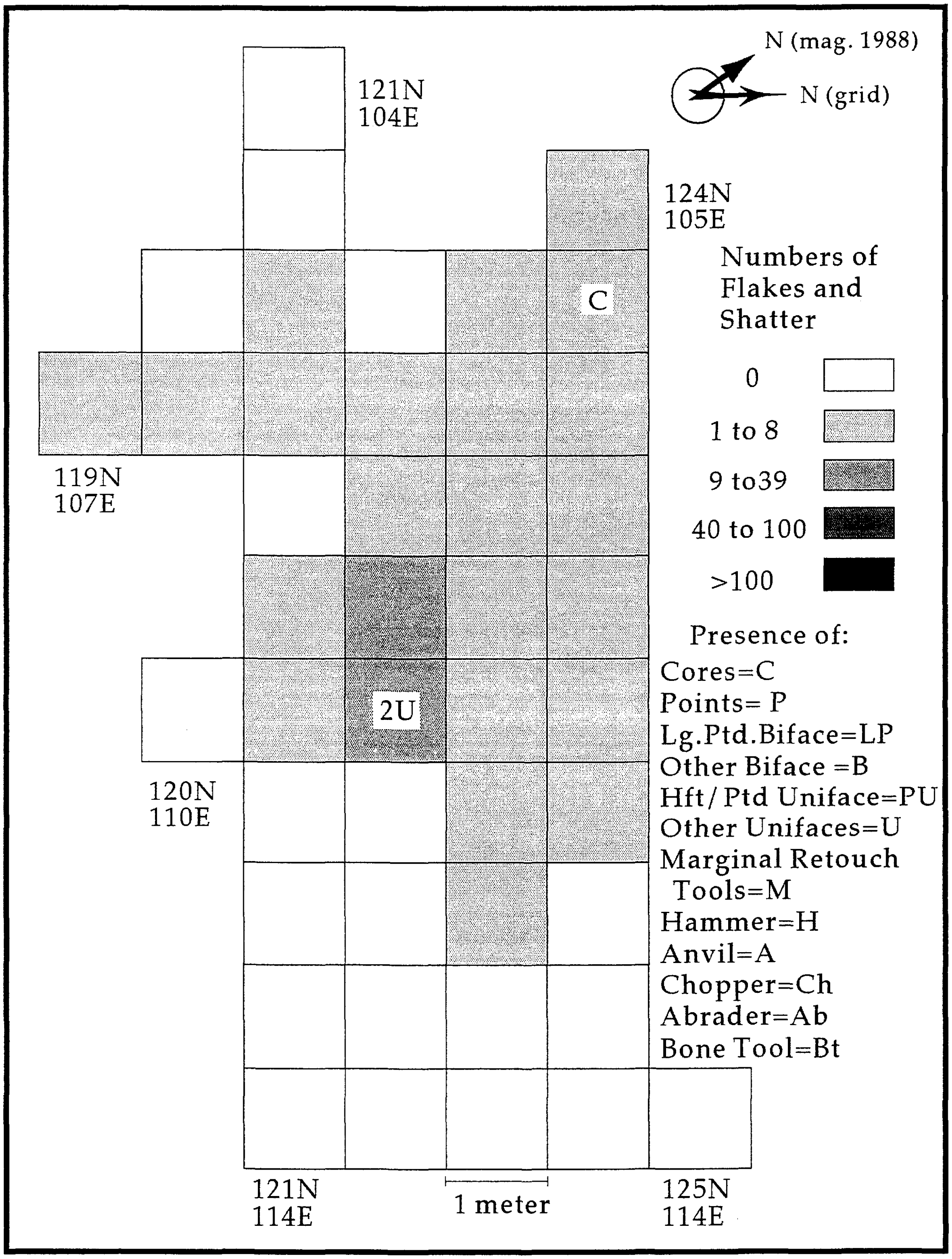


Figure 7.28 Layer 10 Lithic Debris and Tool Distributions

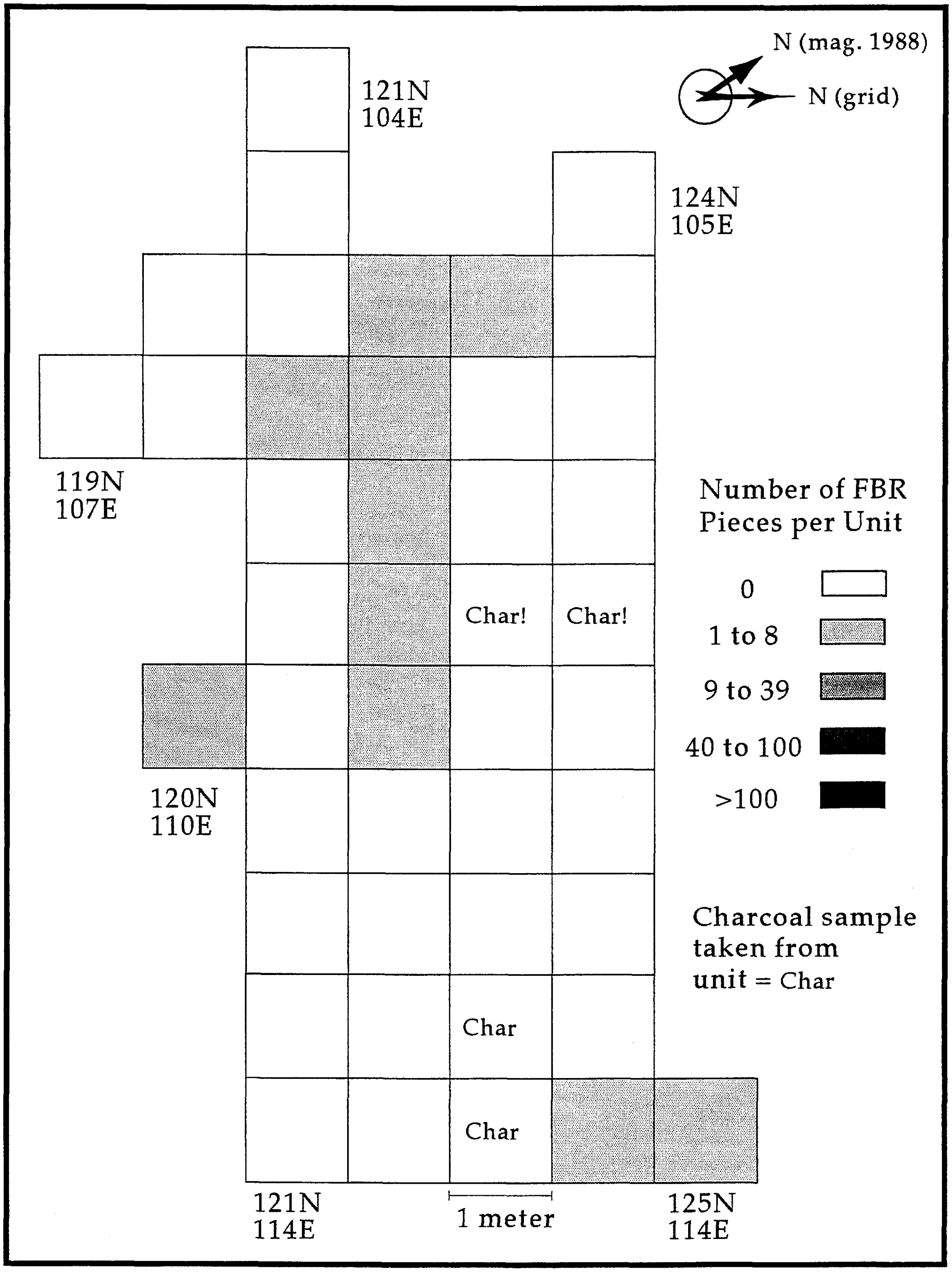


Figure 7.29 Layer 10 Fire-Broken Rock and Charcoal Distributions

Layer 11

Layer 11 features are in three clusters (Figure 7.26). Dense bone concentrations and burned bone are associated with the west end of the block and the southern part of the mid-block concentration of features. Some moderate bone and burned bone accumulations are also associated with the eastern part of the block's features (Figure 7.30). Lithic material distributions indicate a downslope core reduction activity and a larger more varied upslope accumulation (Figure 7.31). A large amount of lithics are found about hearth feature 36. An anvil and ovate biface preform are closely associated with this activity area, and a bone tool is nearby. A point is located in the vicinity of features 33 and 28. Along the south margin, a feature cluster has a smooth-surfaced rock associated with it, and a few units away a unifacial tool is present (Figure 7.31). Fire-broken rock is noted in three main groups (Figure 7.32). The upper part of the block has the largest spatial cluster of FBR. This may relate to its use in features 31, 33, 36, 5 and/or 40. Charcoal samples are noted on the western margins of this area, at the edge of the block excavation. No great degree of clustering of FBR exists here. This may indicate dispersion of FBR, possibly from cultural activity. A more discrete cluster of FBR is associated with the features at the south-central area of the block. These are primarily associated with features 38 and 39. These features contain fragmented bone, ash and charcoal typically reflecting processing of bone for marrow or grease rendering and other midden materials. Such a processing activity may have occurred in pit feature 2, with the area later used as a midden. An outlying FBR concentration is also noted in the extreme northeast corner of the block and may relate to activities associated with feature 32.

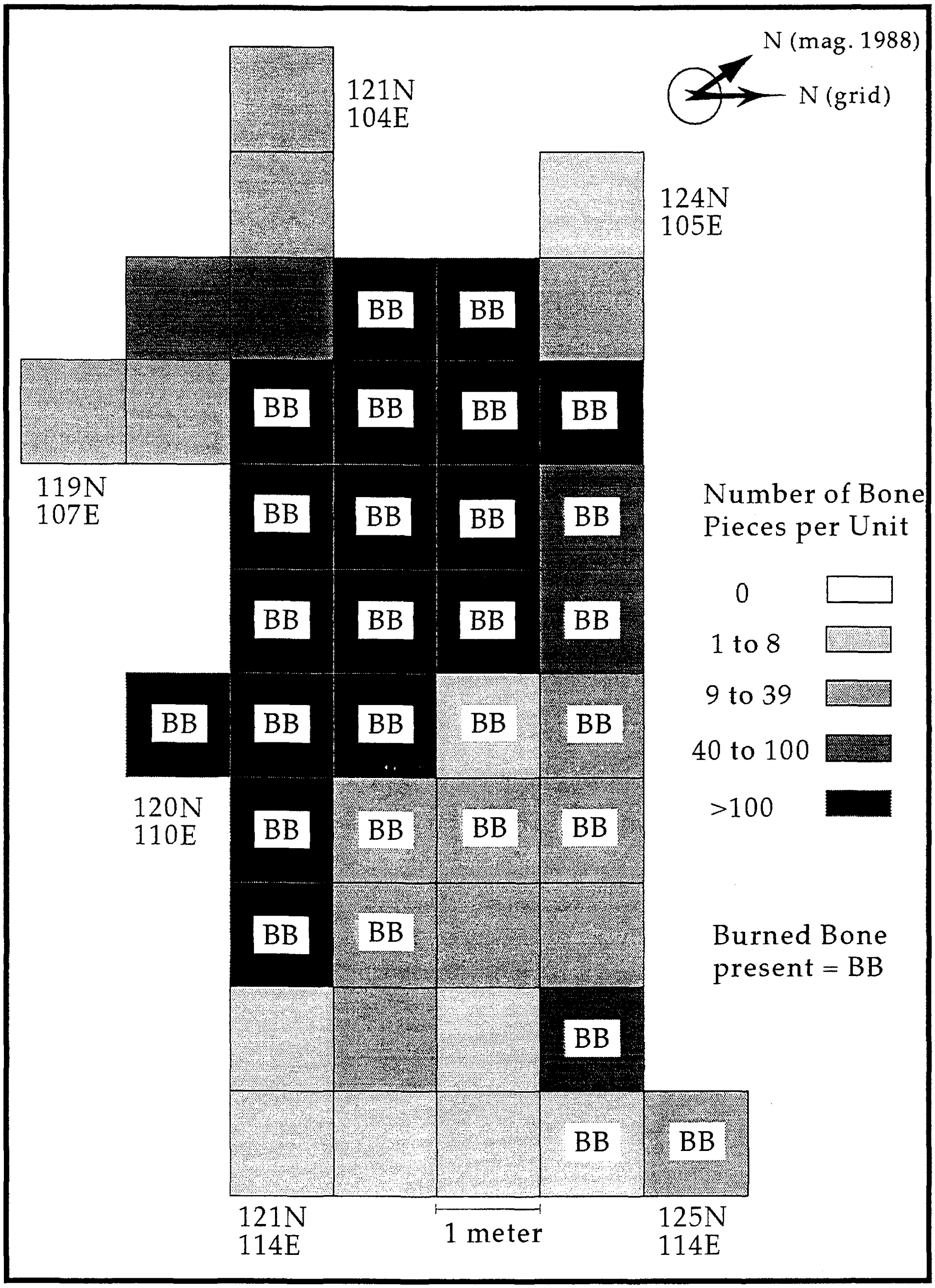


Figure 7.30 Layer 11 Unburned and Burned Bone Distributions

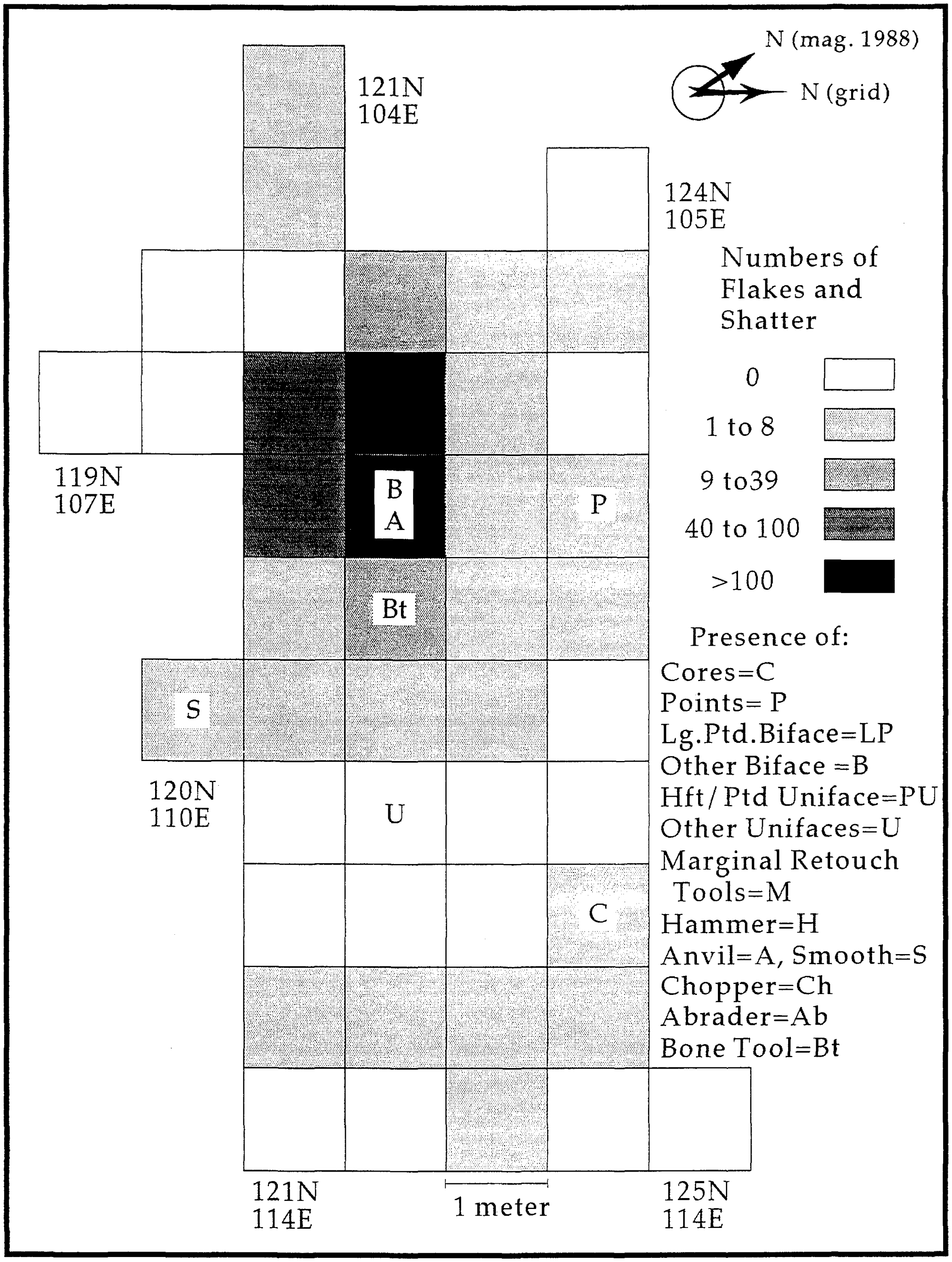


Figure 7.31 Layer 11 Lithic Debris and Tool Distributions

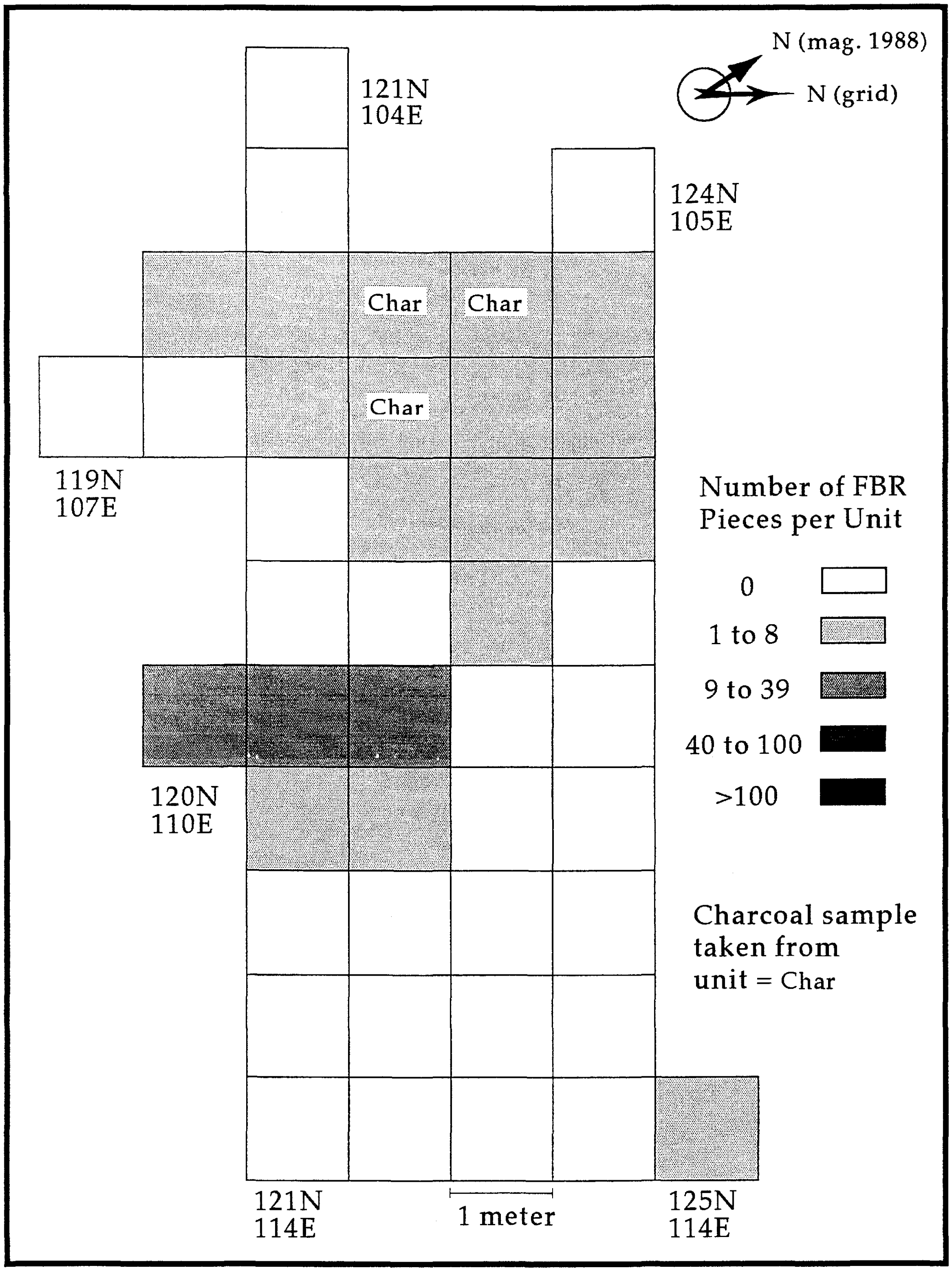


Figure 7.32 Layer 11 Fire-Broken Rock and Charcoal Distributions

Layer 12

Sixteen features are noted in layer 12. Most of these features are clustered in an oval area similar in location to the layer 10 and 11 upper block feature cluster (Figure 7.33). There are also important features outside this cluster. Two of these, features 3 and 4, are pit-like or basin-shaped. There are considerable amounts of material in and near these features. Bone and burned bone scatters permeate this layer (Figure 7.34). High densities of bone and burned bone are clustered in the oval area of the feature cluster. However, there is a continuation and predominance of burned bone and high bone density surrounding and in features 3, 4 and 56. Some high bone and burned bone concentrations extend southeast, and are likely associated with the outlying feature 54.

Lithics are located throughout most of the layer but are highly concentrated in the southern half of the oval feature cluster and outside the cluster to the south and southeast (Figure 7.35). The greatest lithic densities are associated with feature 4 and feature 53. Seventeen of the 20 cores in this layer are present in these features' units, and adjacent units. Also, 13 of the 22 tools present in this layer are in or about feature 4. Most of these are broken fragments or heavily utilized specimens. A hammer and anvil combination tool is also associated with this feature, likely used in the core reduction processes undertaken there or nearby. Four points, two pointed unifaces, two large pointed/hafted bifaces, three marginally retouched stone tools and one bone tool are present in this area. This appears to have functioned as a midden as its final use, although it may have been previously used as a pit for cooking or processing. Fire-broken rock is highly concentrated in and about feature 4, supporting the processing and midden interpretations(Figure 7.36).

Three cores and a marginal retouch tool are in the southern half of the oval feature area. They are associated with features 50, 51, 52 and 53. Moderate

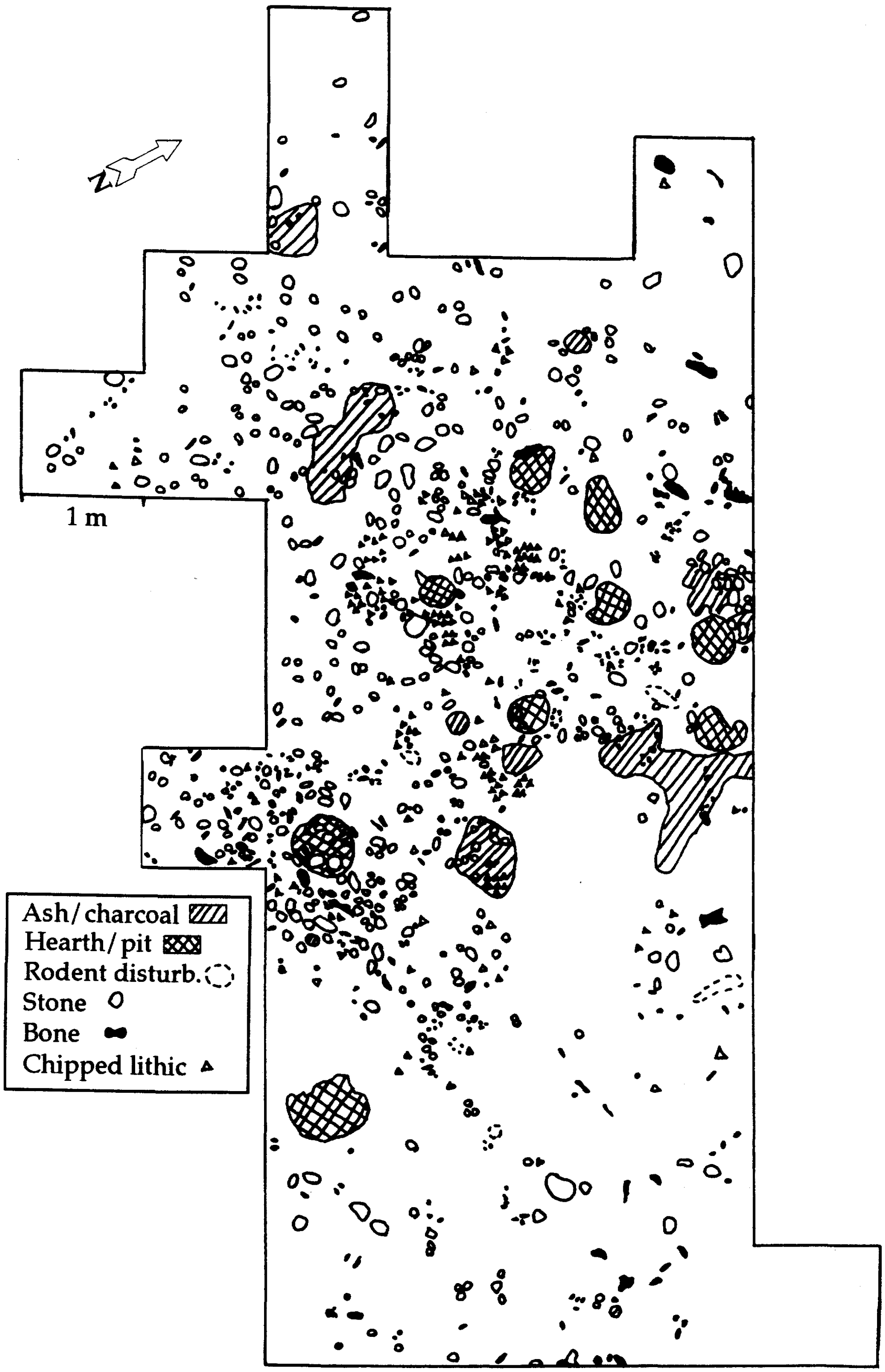


Figure 7.33 Layer 12 point provenienced material distribution map

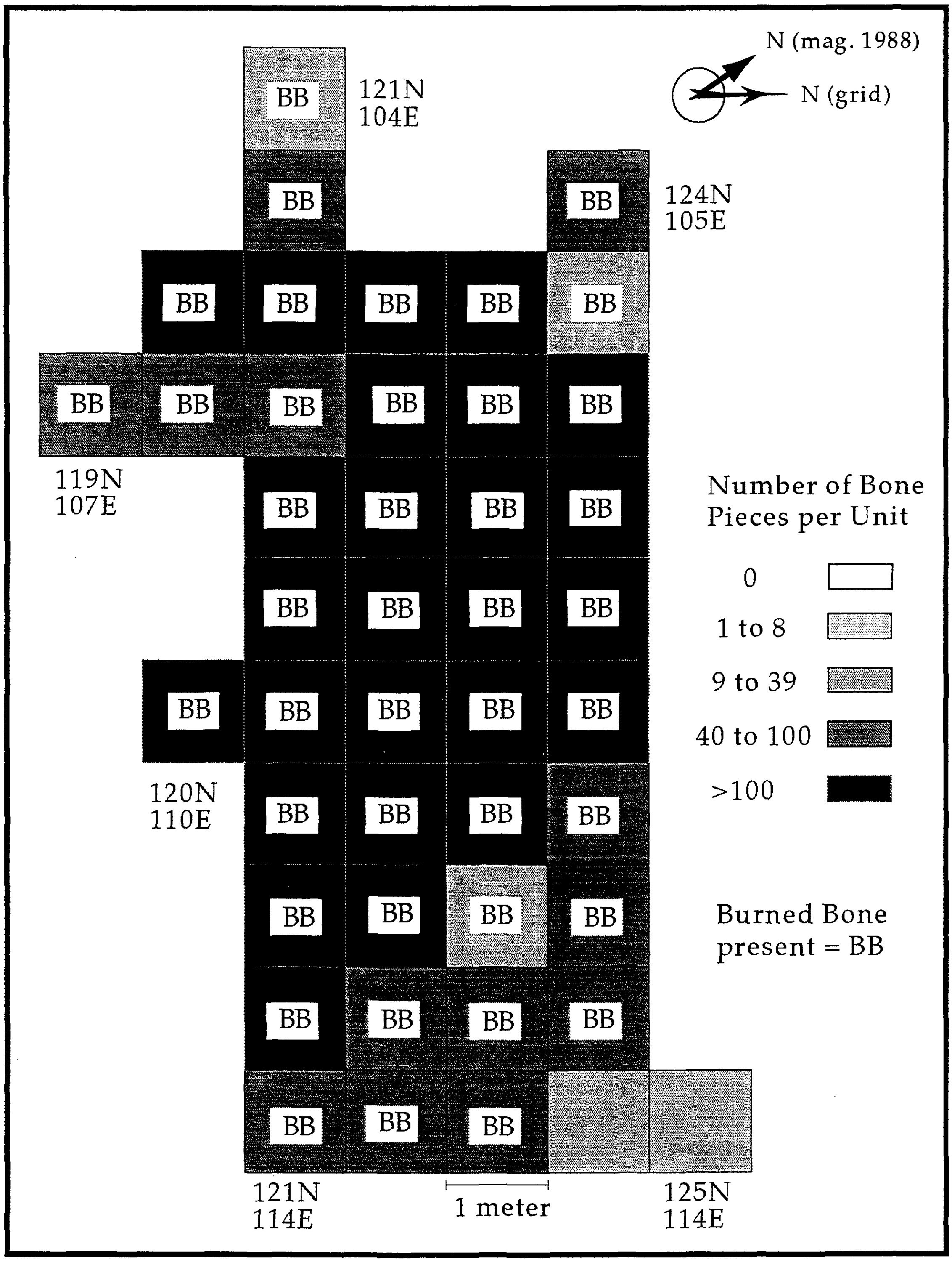


Figure 7.34 Layer 12 Unburned and Burned Bone Distributions

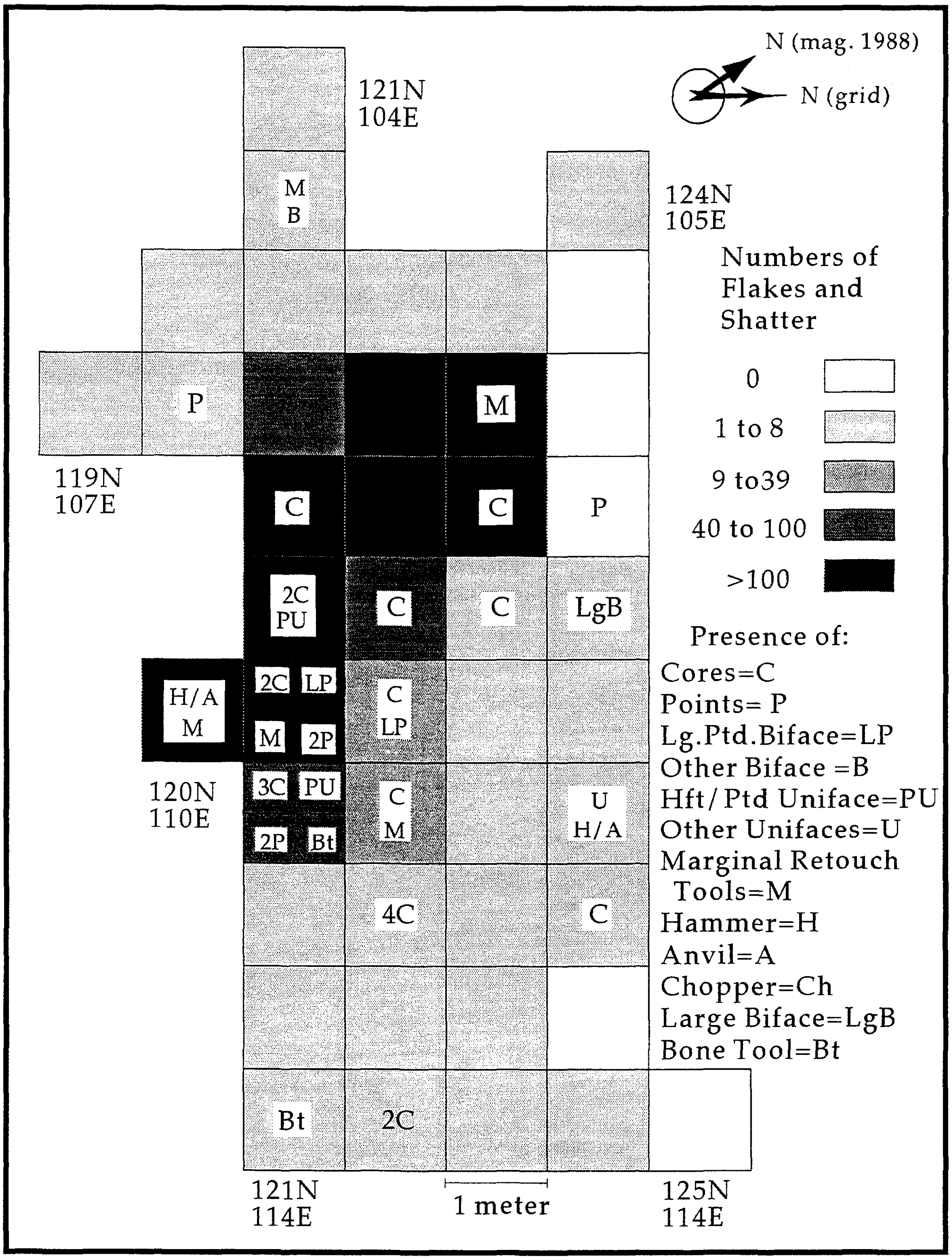


Figure 7.35 Layer 12 Lithic Debris and Tool Distributions

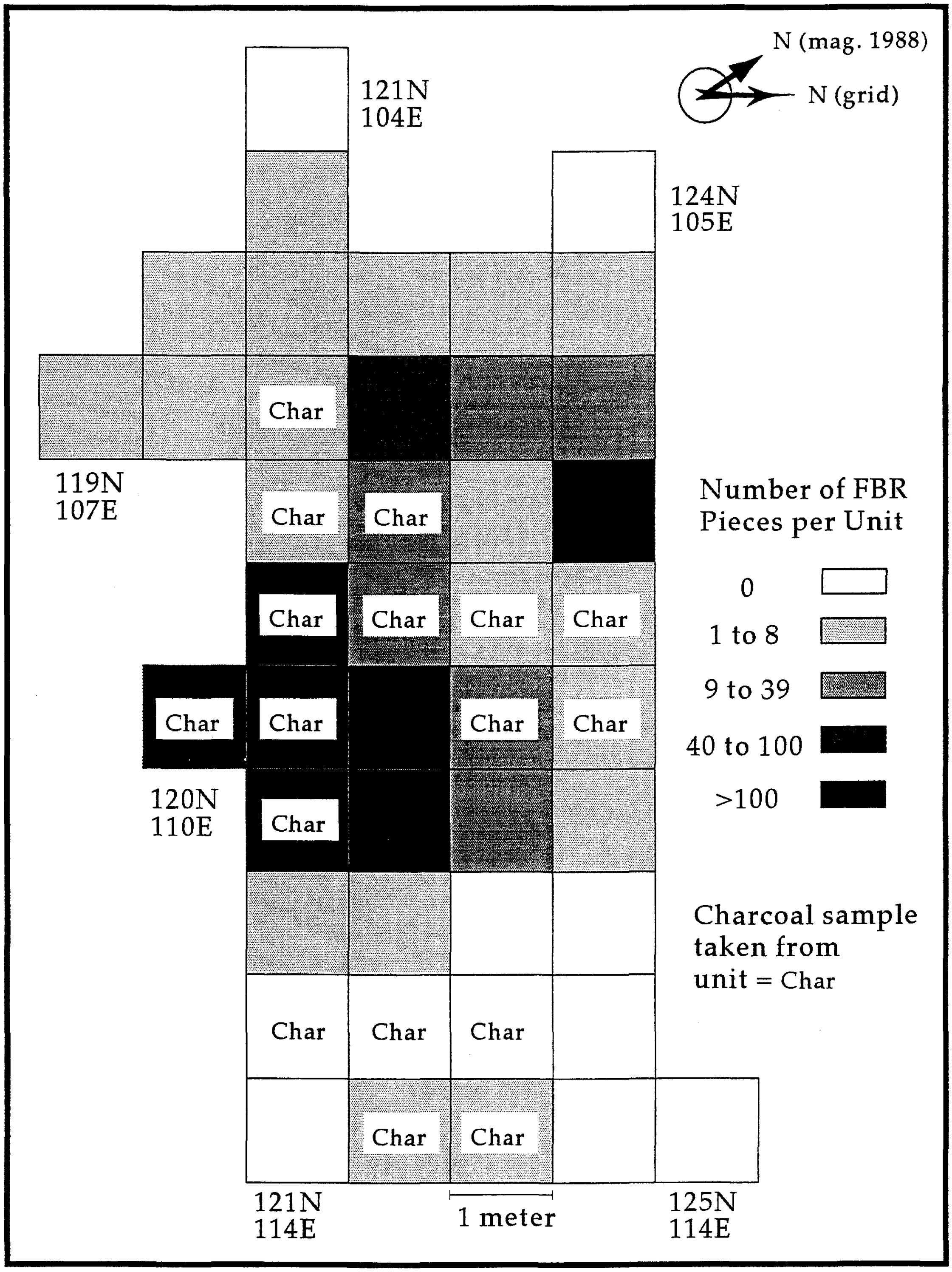


Figure 7.36 Layer 12 Fire-Broken Rock and Charcoal Distributions

amounts of FBR are associated with features 50, 52 and 53. Less FBR is located in the center of this oval area, but on the north margin, features 44 and 45 contain a high number (Figure 7.36). The northern half of the oval area also has a point and a semi-circular limestone biface near features 44 and 47 (Figure 7.35). A biface and marginally retouched tool are associated with feature 54 upslope, in unit 121N 105E. Fire-broken rock is present in this area, but not as densely distributed as in other areas. Also, away from the intense lithic concentrations downslope is a uniface and hammer/anvil in unit 124N 111E and a core in unit 124N 112E. In the southeast corner of the block a bone tool is present with two additional cores in the adjacent unit. Some FBR is present at the east central end of the block, perhaps indicating another activity locus or a nearby hearth. However, this feature must be outside the parameters of the excavation block, unless it is associated with feature 3, over a metre away.

The oval feature cluster and associated distributions suggest a dwelling outline. An opening may be generally to the south as indicated by the nearby midden accumulation. The northern part of the oval, though containing features and bone, is nearly devoid of lithic debris and has an area of lessened intensity of FBR. Features 44 and 47 are hearths with associated ash/charcoal debris (features 45 and 48, respectively) that may have resulted from cleaning the hearths outward from the center of the oval area. These aspects together may suggest a sleeping area, kept free of sharp or messier debris. The southern half of the oval is dense with lithics and FBR but not as dense as the midden area immediately to the southeast.

Layer 13

Layer 13 is composed of four main sublayers. These are separated fairly well in most areas. Fourteen features are noted in these layers and are presented together in Figure 7.14 and in Table 7.1. Layer 13(1) and 13(2) contain five features each, layer 13(3) contains one and layer 13(4) has three.

Layer 13 (1)

The five features in layer 13(1) include 58, 63, 65, 66 and 67 (Figure 7.14). The bone frequency distributions in Figure 7.37 indicate two high concentrations and one lesser concentration. Burned bone is present throughout the block in and between these frequency clusters. Lithics cluster in two main areas, one associated with two of the upper block bone clusters and the other with the lower block bone cluster (Figure 7.38). Fire-broken rock distributions indicate two upper block clusters corresponding with the upper block lithic and bone concentrations (Figure 7.39).

Some of this upper block concentration is related to activities at and around features 58 and 65. Other upper block concentrations may indicate an additional feature unrecognized and/or disturbed by natural processes, such as rodent disturbances present in this area (see Figure 7.14). Concentrations of lithics in this area are due partly to core reduction activities, as eight cores are found in this area. A biface and large, pointed, hafted biface is also present. A grooved abrading tool and marginally retouched tool are adjacent to feature 65. This area also had several charcoal samples collected from it.

Farther downslope, pit feature 66 is associated with the highest concentration of FBR. It also has moderate amounts of bone and burned bone associated with it, and contains a few chipped lithics including two cores.

Features 63 and 67 are most closely associated with the high bone concentration at the southeast end of the block. Chipped lithic are also higher in frequency in this area, but only a few FBR are noted.

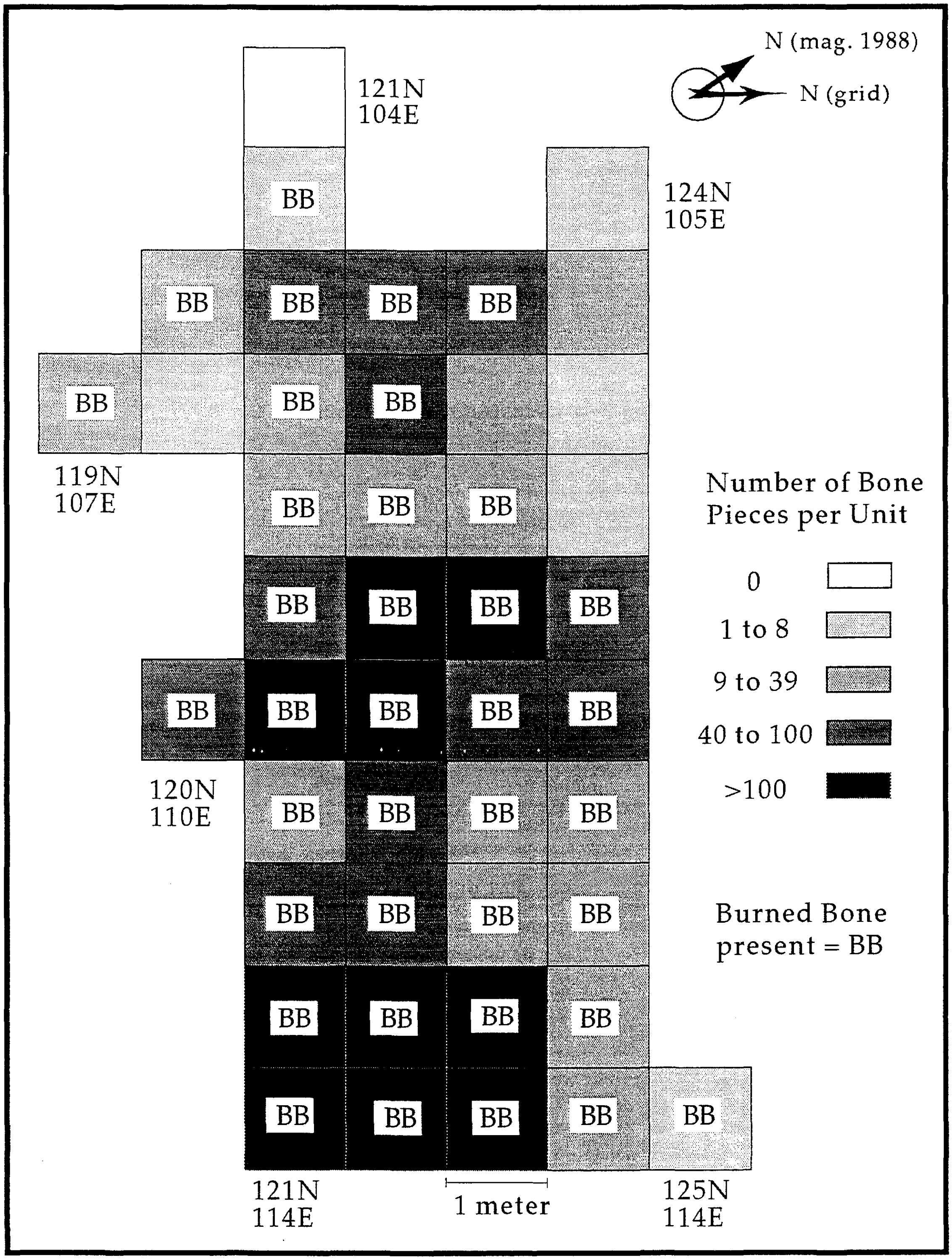


Figure 7.37 Layer 13(1) Unburned and Burned Bone Distributions

Layer 13(2)

The five features in layer 13(2) include numbers 1, 7, 59a, 60 and 62 (Figure 7.14). High bone concentrations throughout the bottom half of the block generally coincide with these feature locations (Figure 7.40). Lithic distributions are more concentrated with the downslope feature locations. However, there is also a smaller concentration at the west end of the block (Figure 7.41). Fire-broken rock distributions correlate strongest with features 59a, 62 and 60 respectively (Figure 7.42). There is again a lesser presence of FBR upslope, in the same area as the smaller lithic concentration. A separate cluster of burned bone is also indicated in this area. This suggests a feature in this area, disturbed by post-depositional processes or peripheral to the block. With the general compression of layer 13 upslope, this "phantom" feature may possibly be the same one indicated in layer 13(1). Poorer occupational separation (indicating generally less deposition to aid in preservation) may account for the missing feature.

Downslope, however, the correlations with features are more evident. The southwestern portion of this large concentration of bone and burned bone correlates with charcoal and FBR concentrations between features 59a, 60 and 62. The few tools that are scattered about these features include a large pointed/hafted biface, a marginally retouched tool, a bone tool and a smooth-surfaced rock. Two cores are also in this area.

Hearths 1 and 7 in the northeast corner, however, seem to be the focus of most of the lithic production/reduction activities. Besides greater amounts of lithic debris, several chipped stone tools are concentrated about these loci. Three unifaces are in and adjacent to feature 7. Four cores, two points and a marginally retouched tool are located between or adjacent to features 1 and 7.

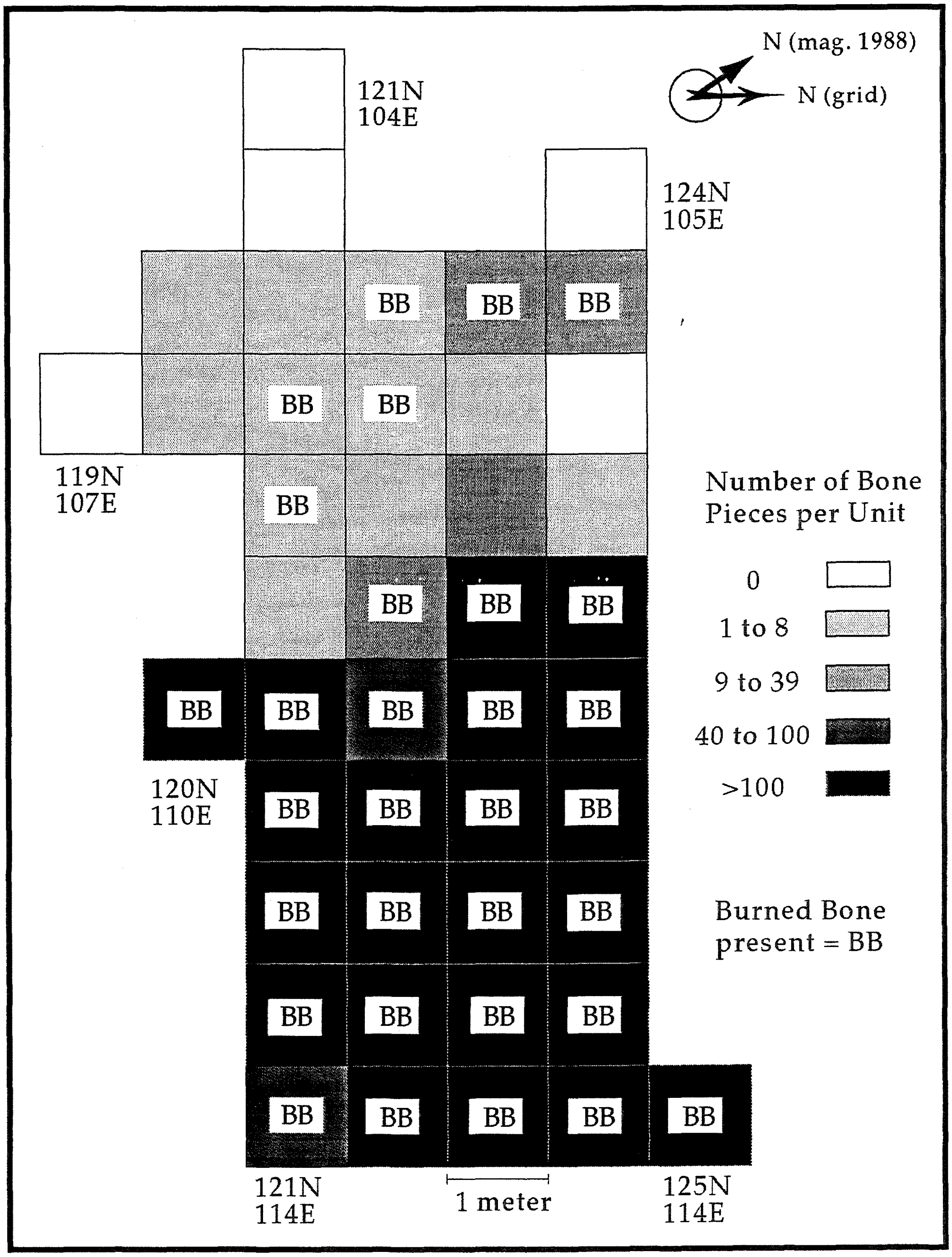


Figure 7.40 Layer 13(2) Unburned and Burned Bone Distributions

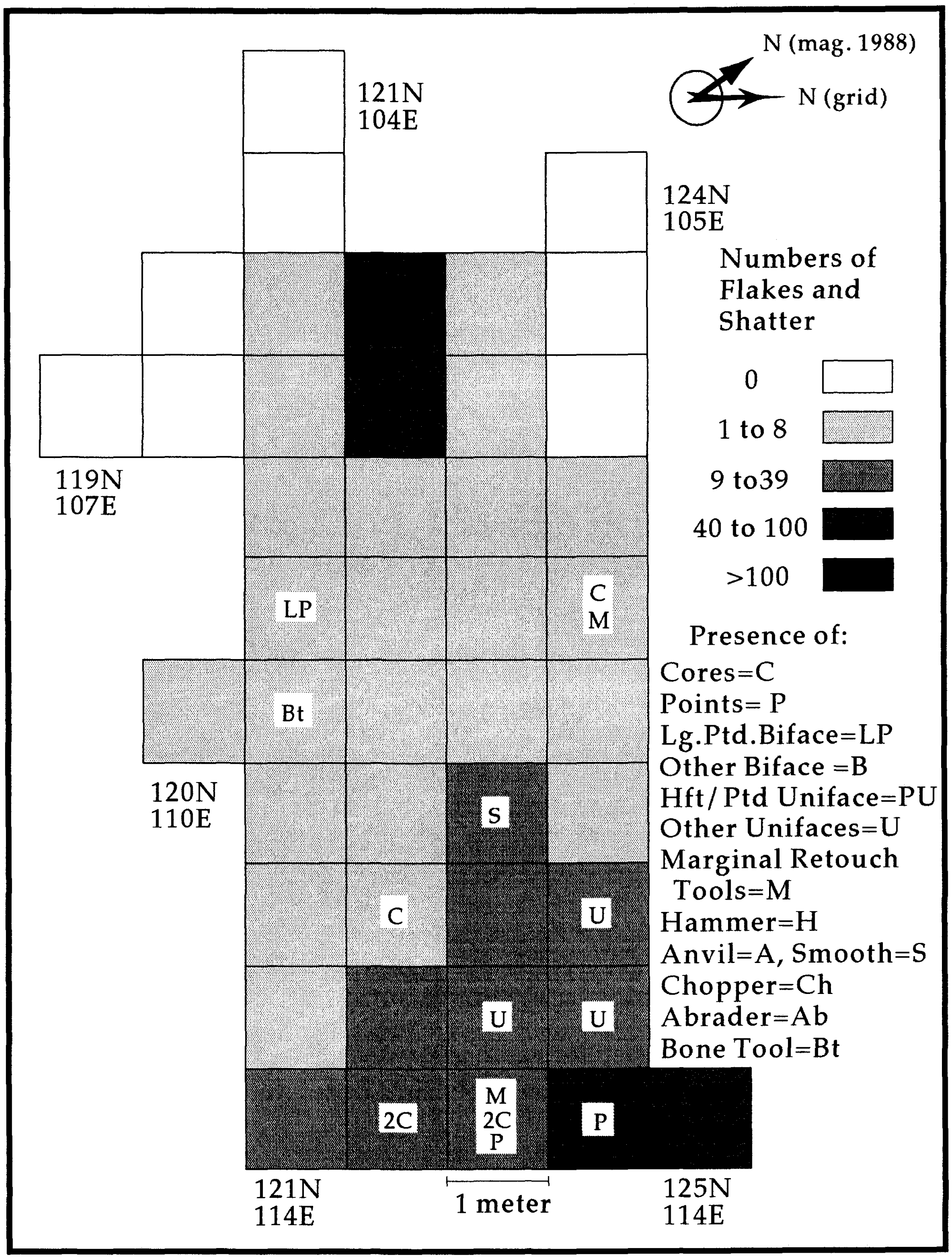


Figure 7.41 Layer 13(2) Lithic Debris and Tool Distributions

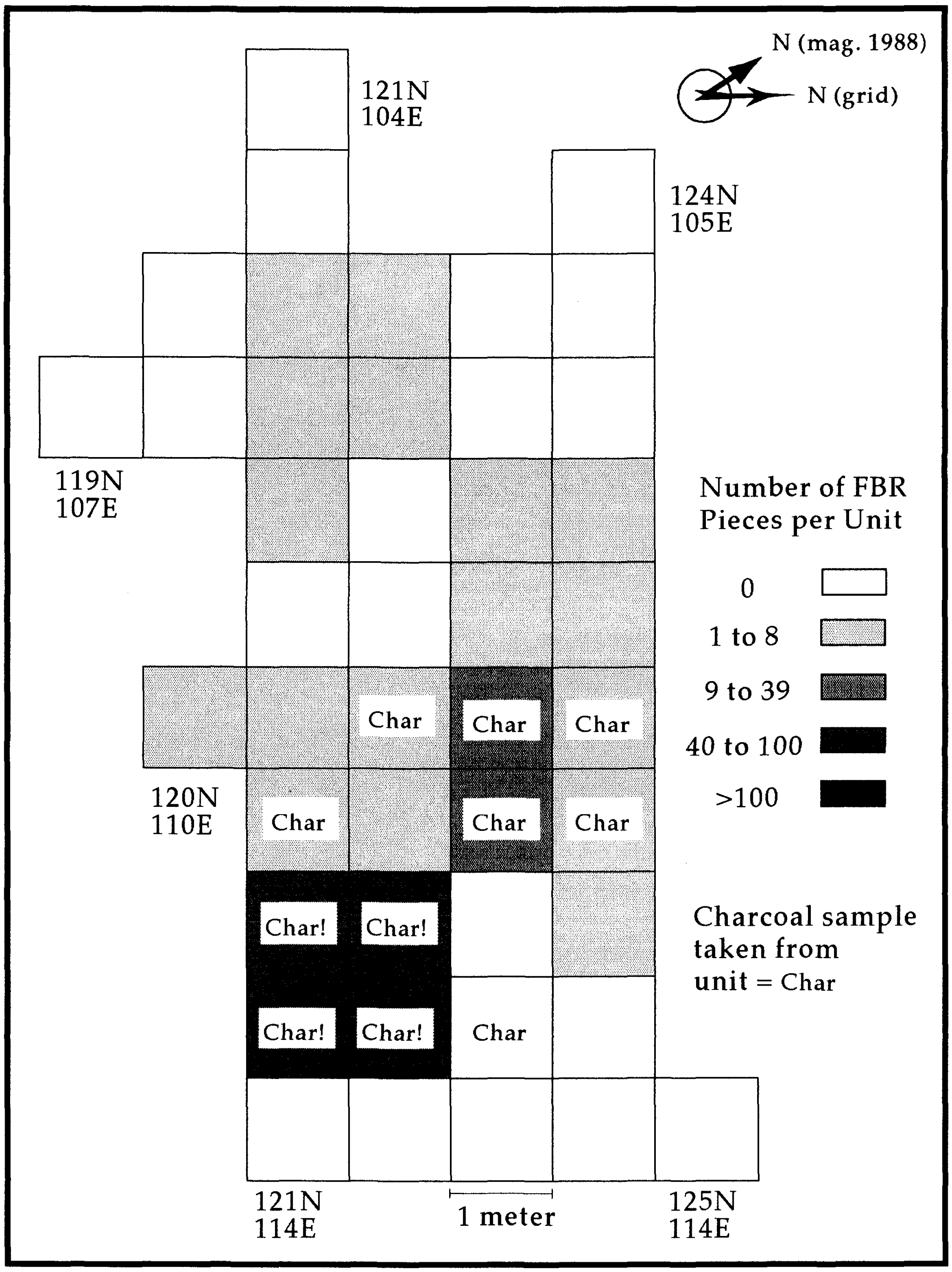


Figure 7.42 Layer 13(2) Fire-Broken Rock and Charcoal Distributions

Layer 13(3)

Only one feature is noted in layer 13(3). However, bone distributions indicate three or four concentrations of materials. One of these correlates with feature 59b (Figure 7.43). This may relate to the function of this feature, because FBR is most strongly correlated here and the only stone tool present in this layer is associated with this feature (Figures 7.44 and 7.45). A core is also associated with this hearth even though no lithic debris is associated. The highest concentration of bone, burned bone, lithic debris and FBR are in the northeast corner adjacent to the walls of the block.

Upslope a general lithic scatter includes two cores. Three clusters of FBR are also located upslope with eight samples of charcoal collected in this area. Bone and FBR clusters suggest an activity locus at 122N 110E and 123N 106E. The first of these is associated with burned bone, indicating a hearth. Charcoal, FBR and lithic debris may indicate another adjunct locus centered at 121N 107E.

Layer 13(4)

Layer 13(4) contains three features (Figure 7.14). Bone distributions correlate strongly with feature 6 and moderately with the other two features. A distinct bone concentration is noted in the northeast corner of the block (Figure 7.46). Lithic debris correlates with the three features and the additional bone concentration (Figure 7.47). Fire-broken rock and charcoal correlates strongly with the three features and some charcoal is located in the northeast corner bone concentration (Figure 7.48).

Feature 6 has a biface and a chopper/hammer tool associated with it, in addition to a core. Feature 4 has two points and two cores associated with it. A biface is near feature 64. A hammerstone is associated with the bone concentration in the northeast corner of the block. Lithic debris is diffused and spread primarily to the southwest of these cluster of activity loci.

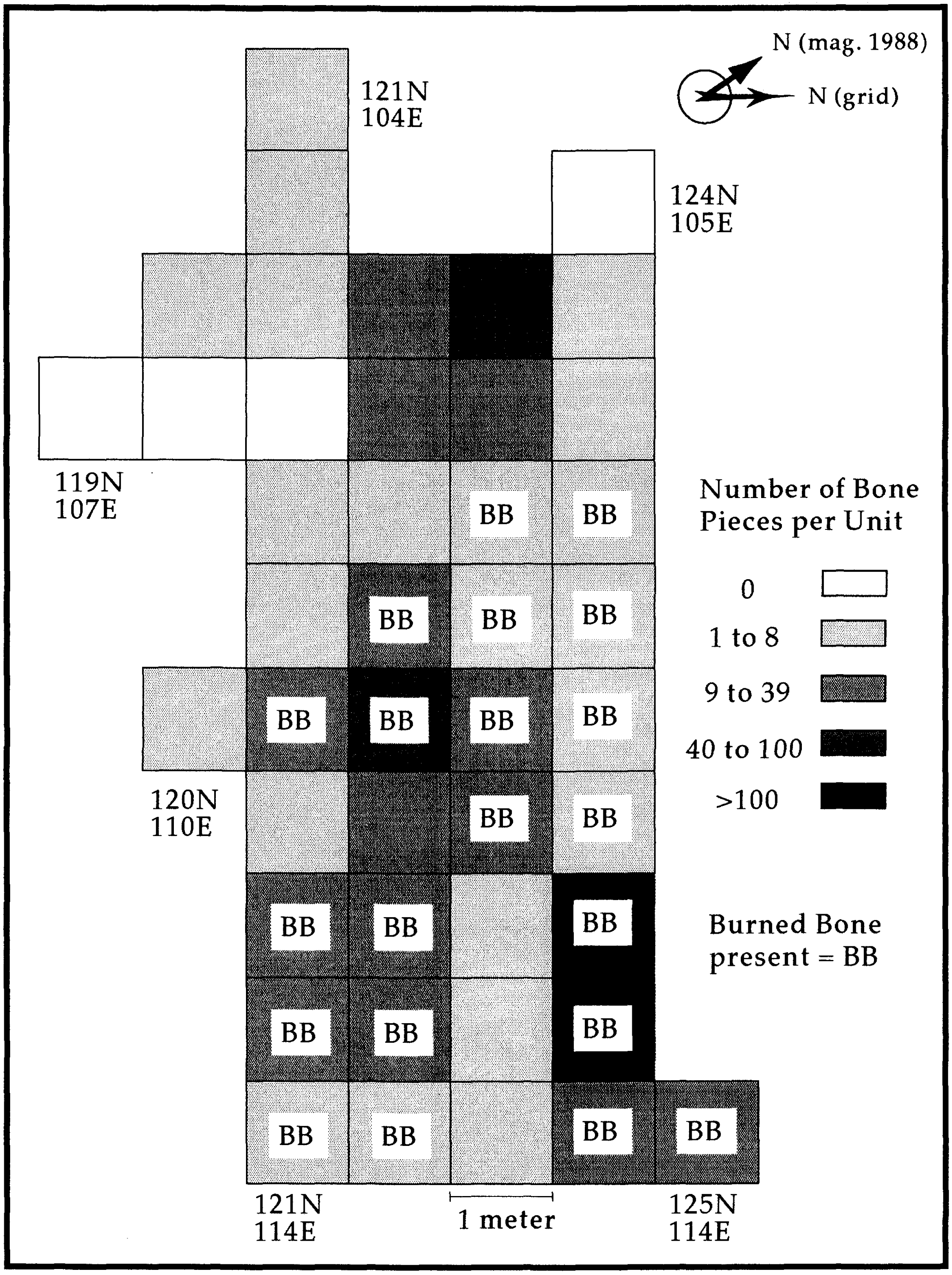


Figure 7.43 Layer 13(3) Unburned and Burned Bone Distributions

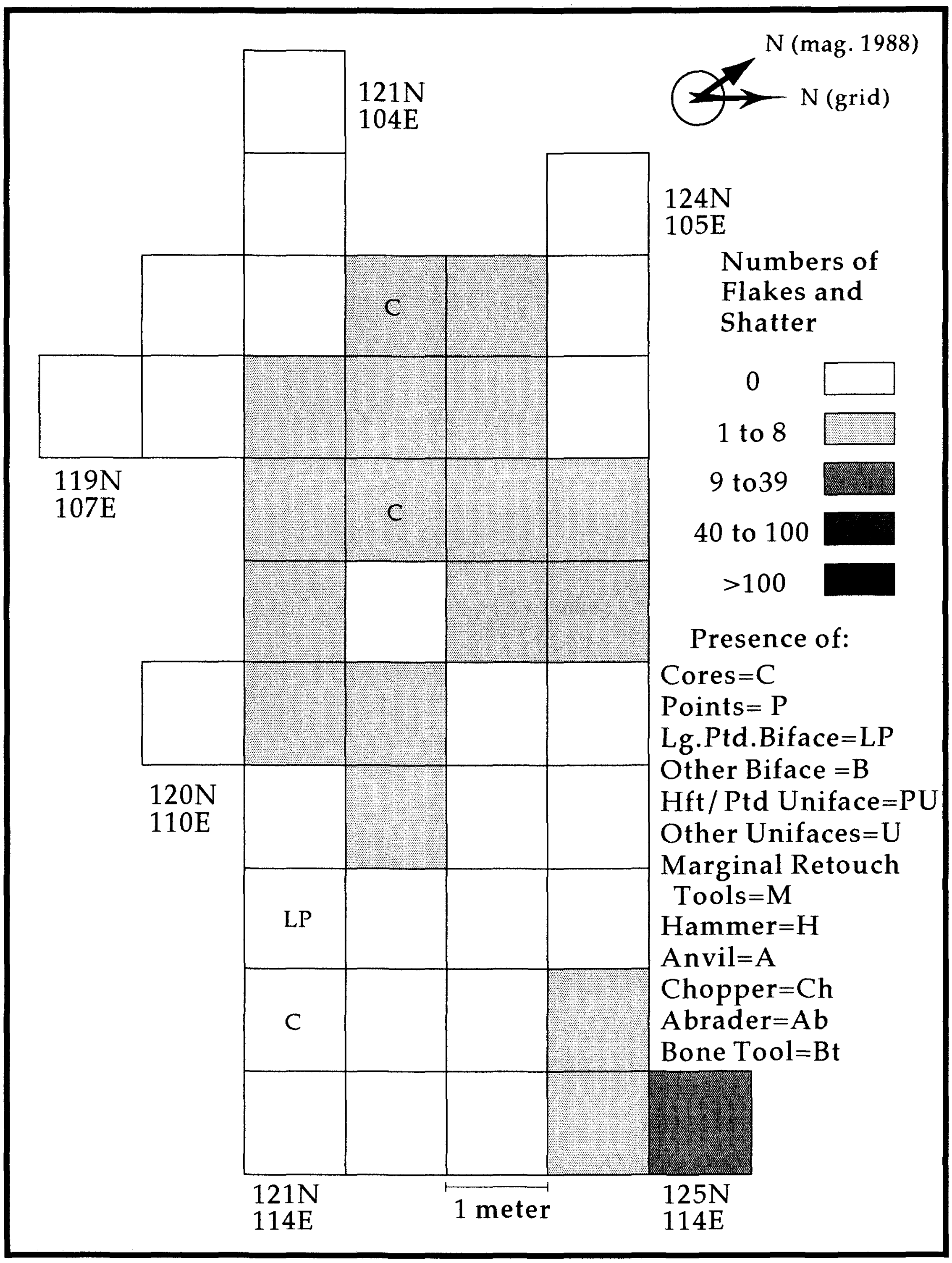


Figure 7.44 Layer 13(3) Lithic Debris and Tool Distributions

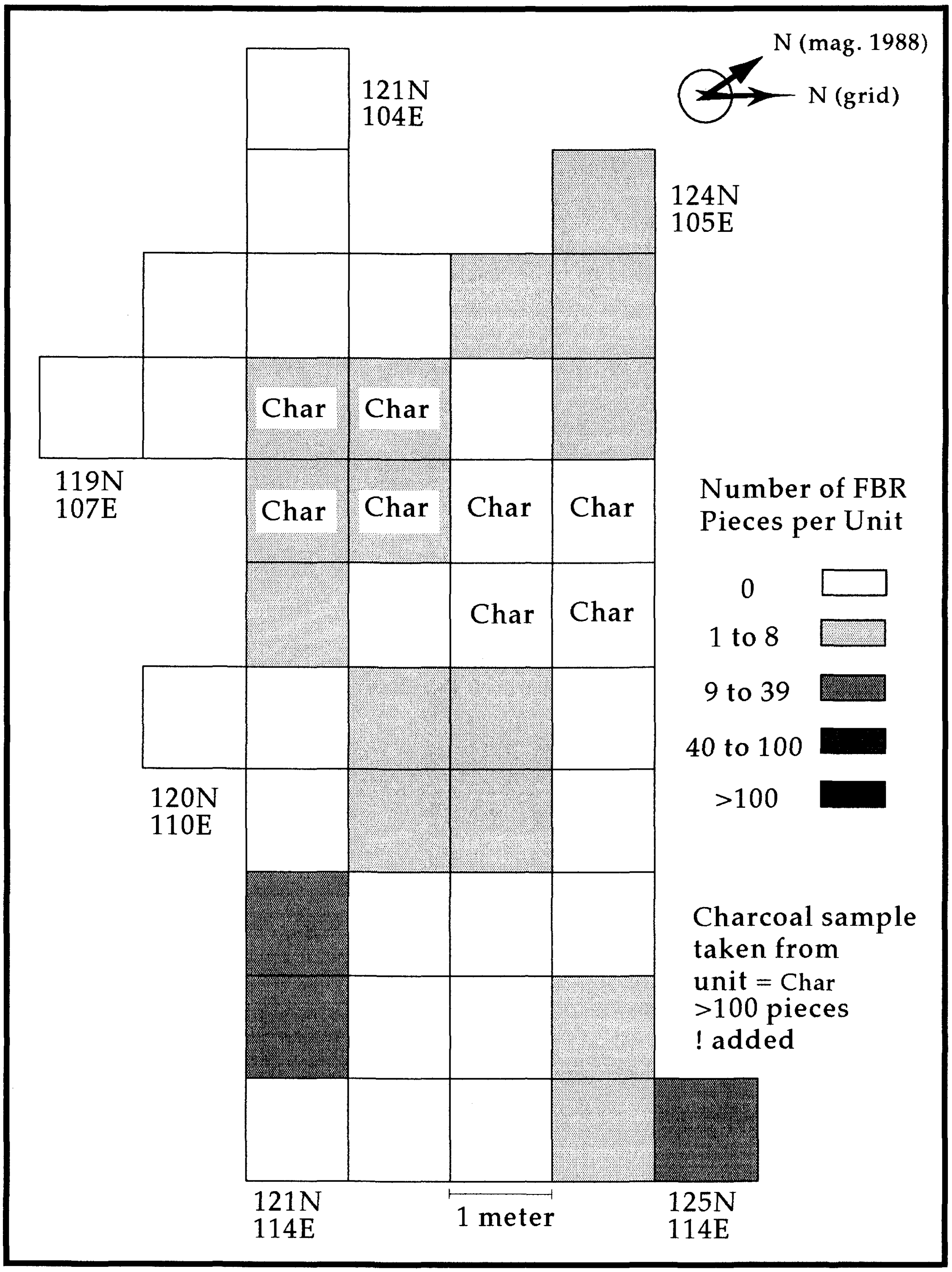


Figure 7.45 Layer 13(3) Fire-Broken Rock and Charcoal Distributions

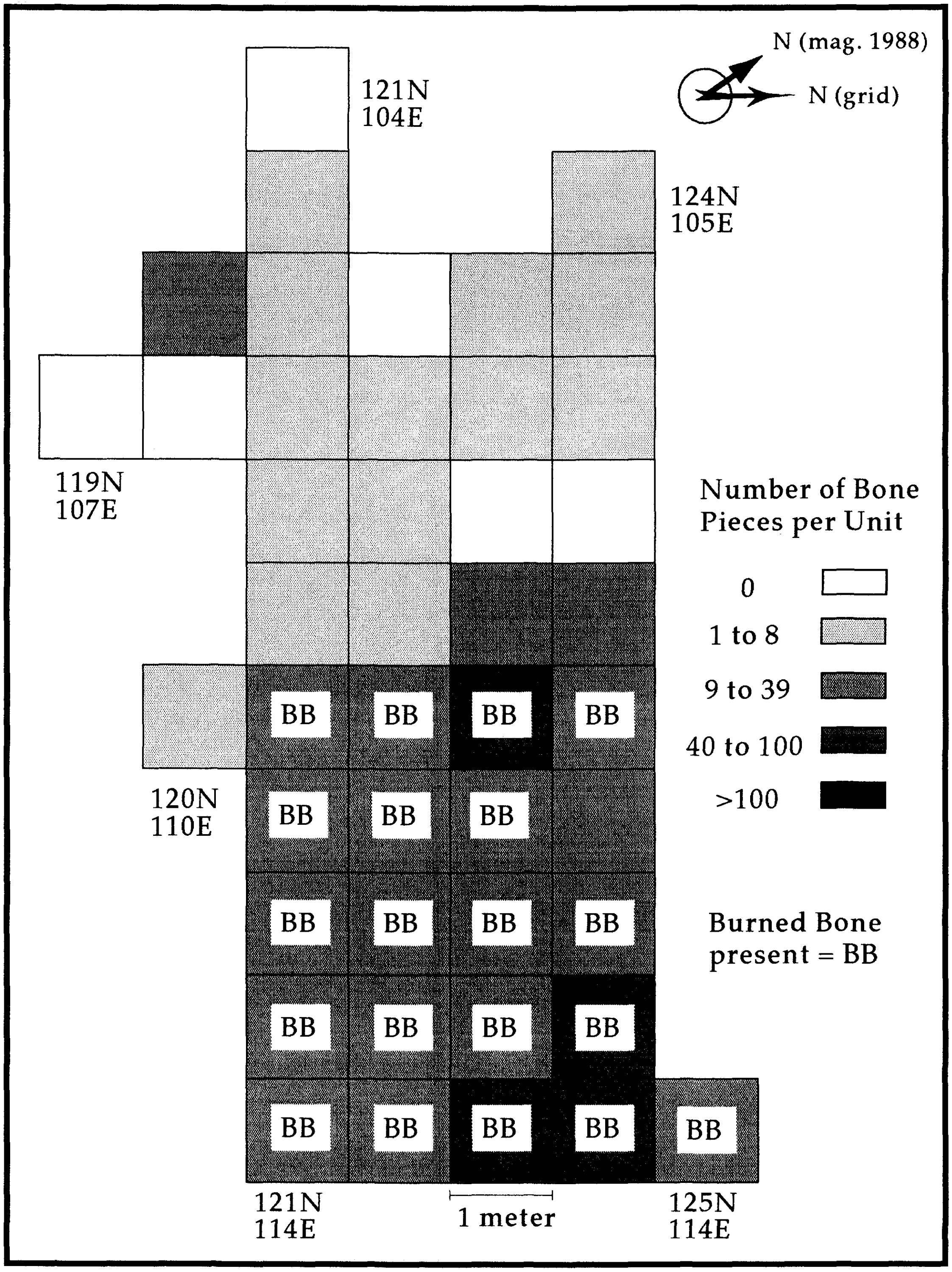


Figure 7.46 Layer 13(4) Unburned and Burned Bone Distributions

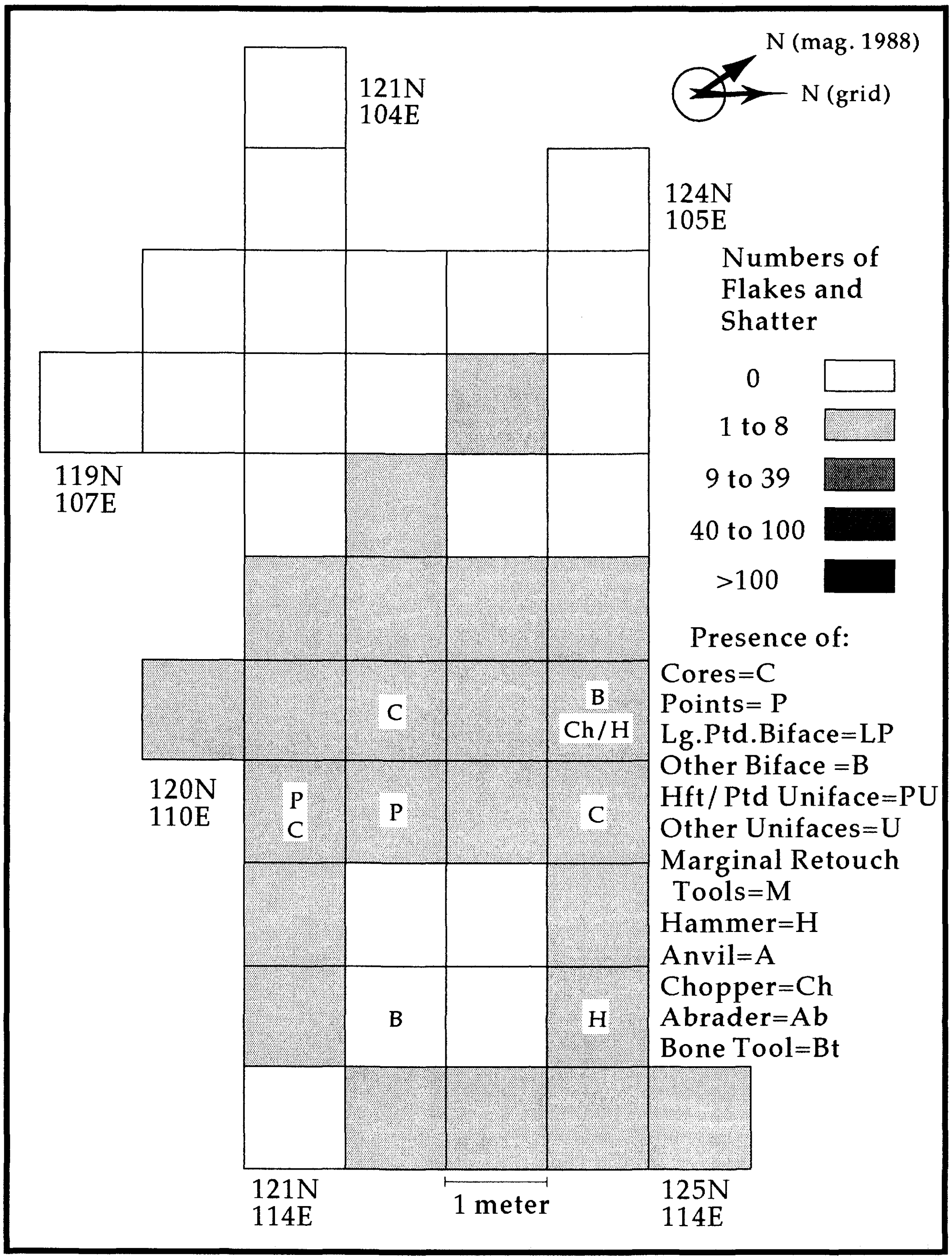


Figure 7.47 Layer 13(4) Lithic Debris and Tool Distributions

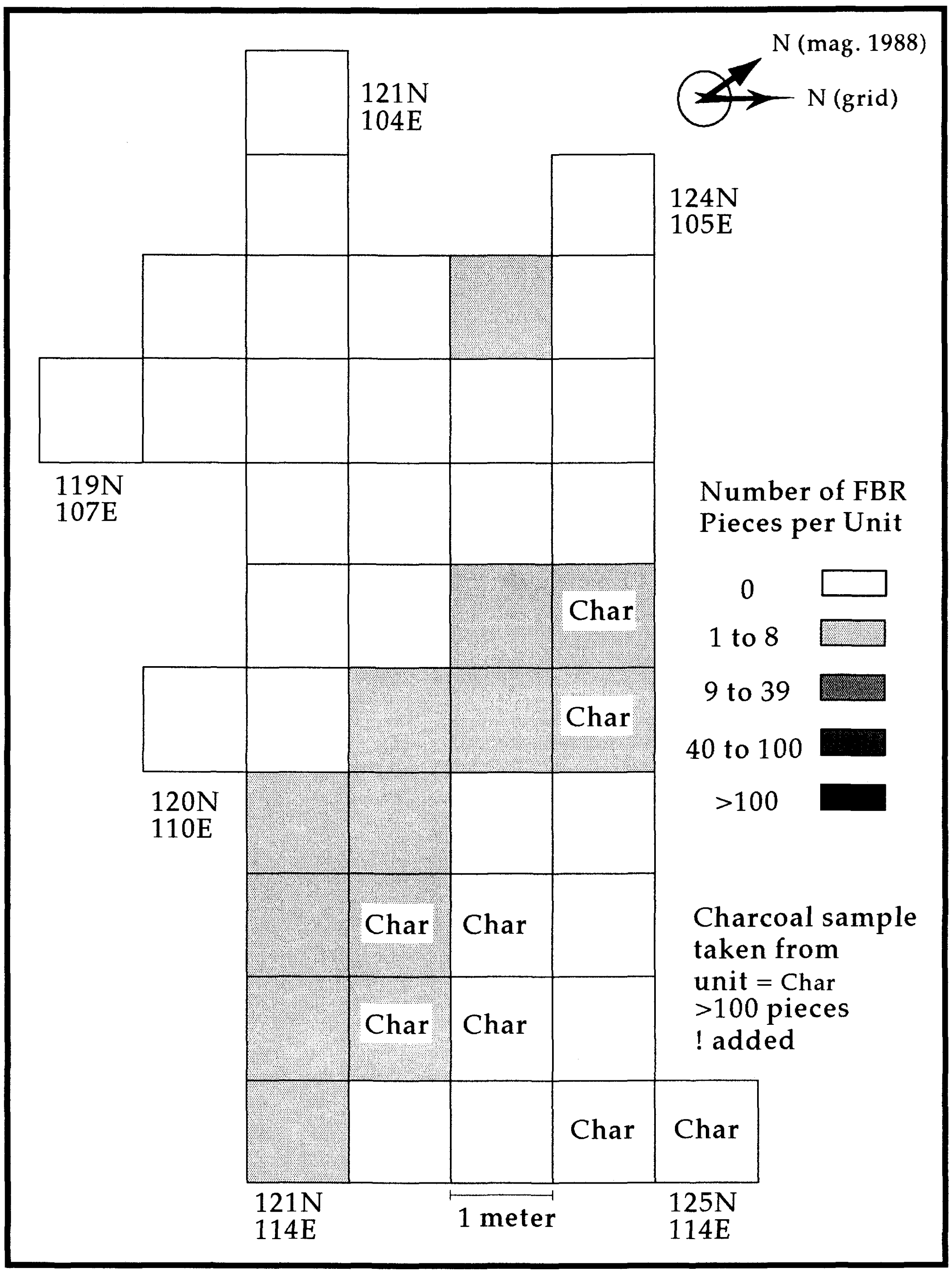


Figure 7.48 Layer 13(4) Fire-Broken Rock and Charcoal Distributions

Layer 14

Layer 14 has no features, as defined, but contains two probable bone reduction areas. These are located in units 122N 114E and 124N 114E, and correlate strongly with the bone frequencies in Figure 7.49. Lithic materials are located farther upslope and are dispersed around two cores located in unit 121N 111E (Figure 7.50). Fire-broken rock has two clusters. One of these correlates with the bone cluster in unit 122N 114E, but is centered in the units just west of this. A denser concentration of FBR is noted in a four-unit cluster in the center of the block (Figure 7.51). This may indicate that a feature was located at this locus. The layer 14 sublayers are sparse and poorly defined. Thus they have been treated as one layer here to provide a general indication of activity loci and their various associations. No charcoal samples are collected from these layers. The leaching processes through these lower coarser sediments have likely removed the organic remains from hearths.

Layer 15

Four units are depicted in Figure 7.52 that indicate lithic and faunal presence. Unit 122N 110E was excavated deepest and contains three sublayers of 15 and thus has the highest concentration of bone. Lithics are sparse but consistently represented in all units. Burned bone is present in two units suggesting that a hearth is nearby. Little can be stated about these lower layers due to their small areal exposure and few remains.

7.6) Discussion

Through the layers 8 to 15, sixty-nine features have been identified. There are many general associations noted within, between and surrounding them. Such associations indicate the location of more intense human activity. Some material distributions and feature patterns may also indicate a tipi, pithouse or other structure.

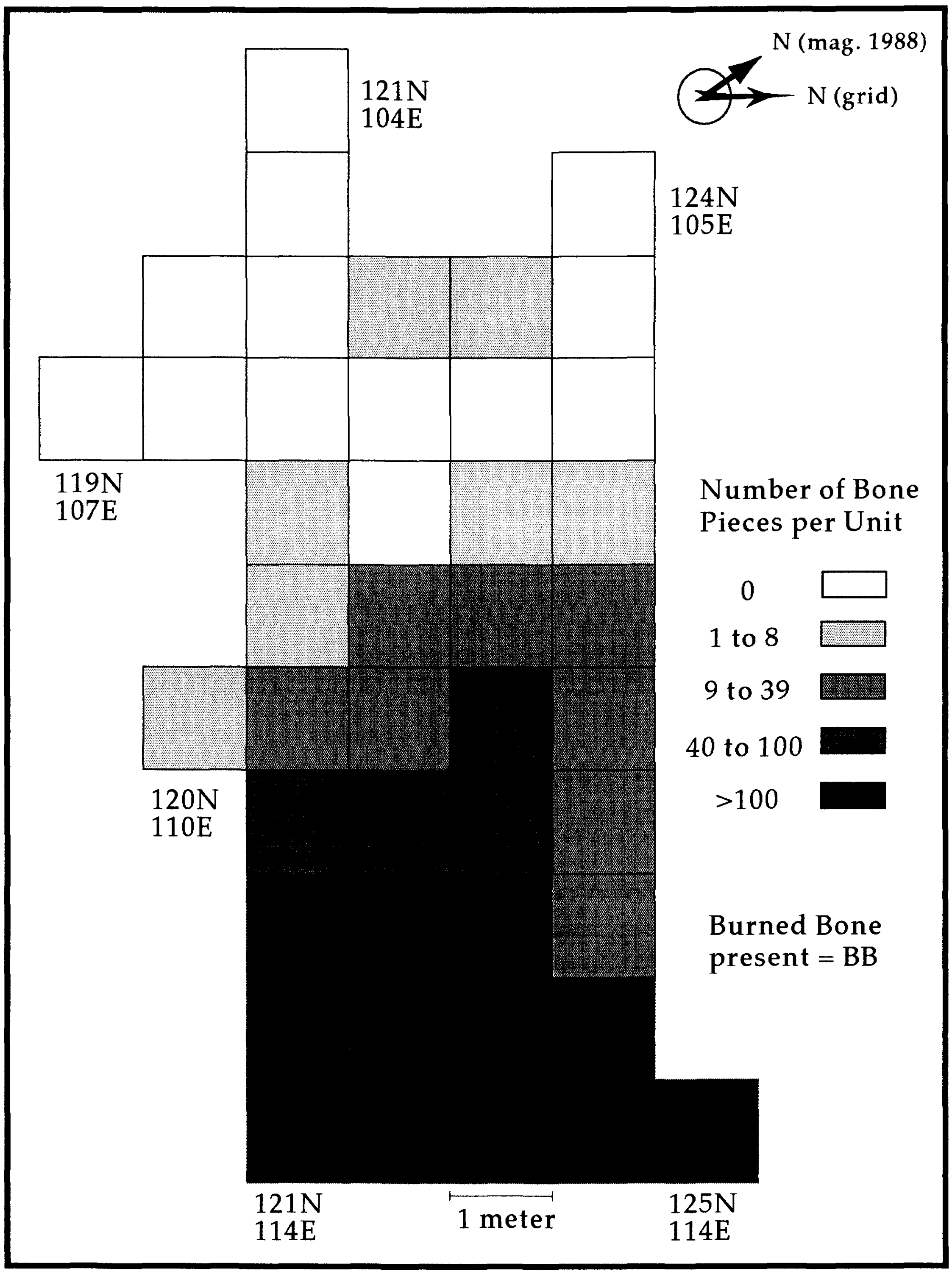


Figure 7.49 Layer 14 Unburned and Burned Bone Distributions

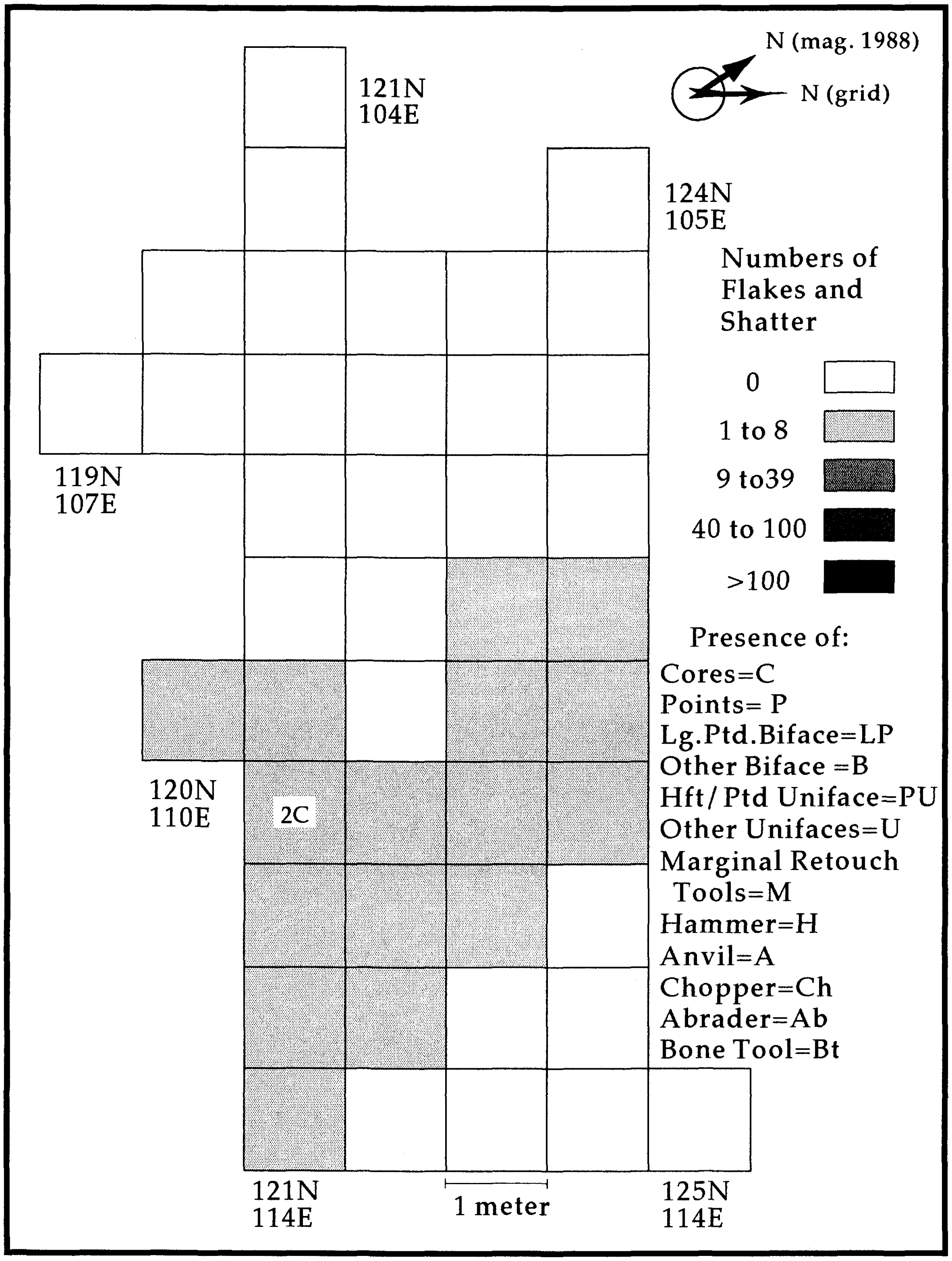


Figure 7.50 Layer 14 Lithic Debris and Tool Distributions

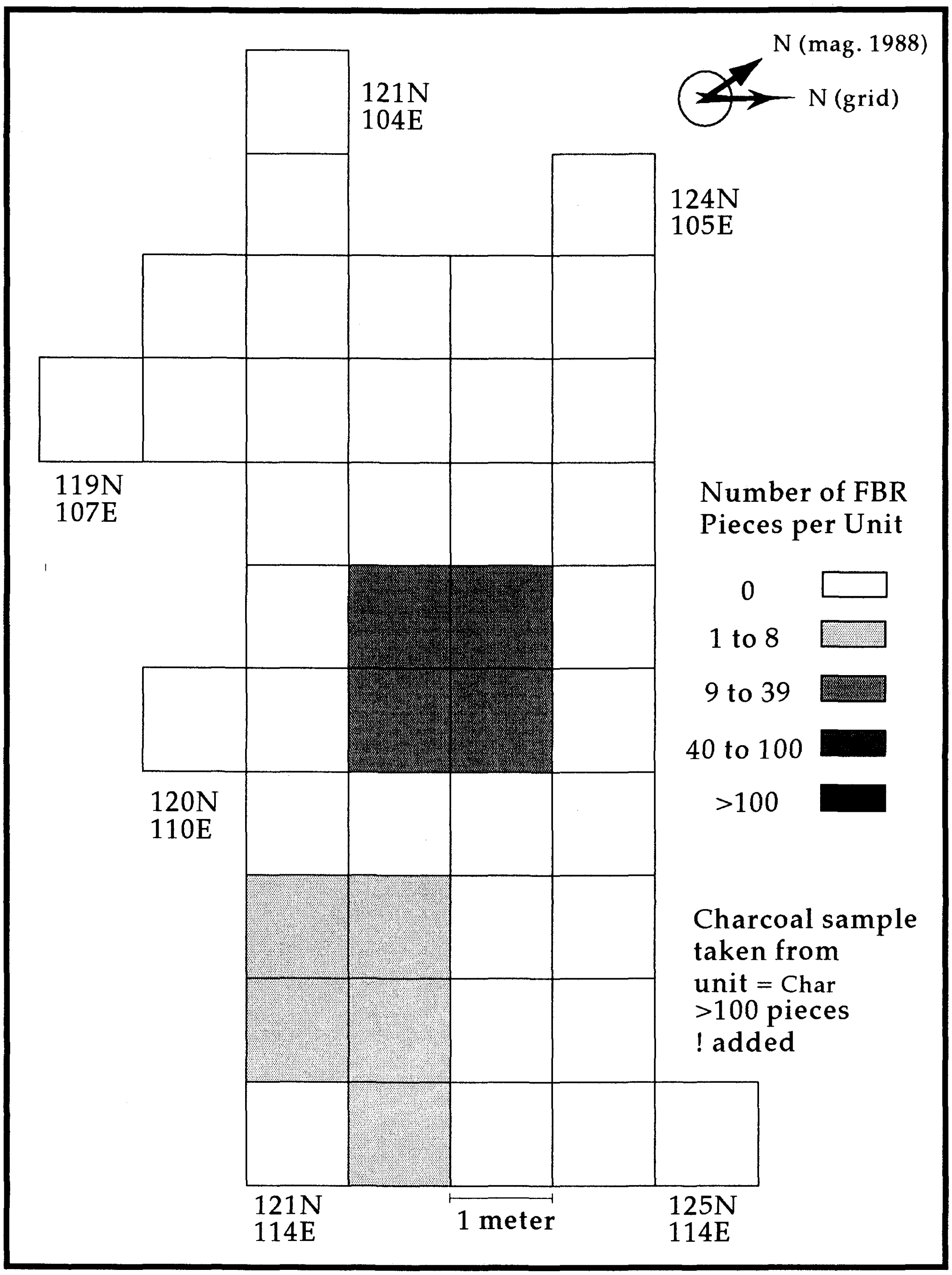


Figure 7.51 Layer 14 Fire-Broken Rock and Charcoal Distributions

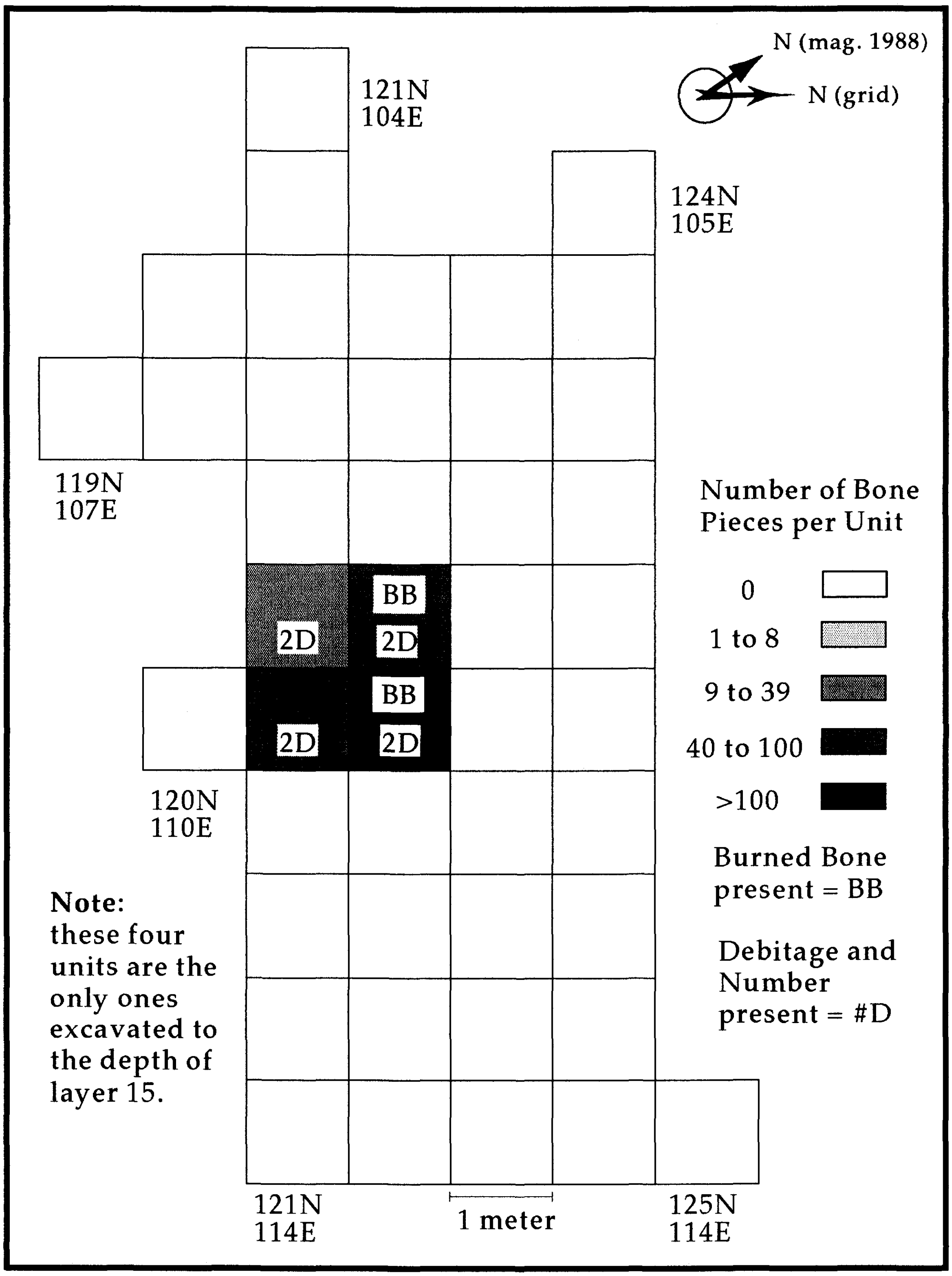


Figure 7.52 Layer 15 Unburned and Burned Bone and Lithic Distributions

Some generally recurring patterns or relationships between layers may be noted. Many charcoal and ash concentrations are downslope from primary features (e.g. hearths and pits). This may indicate that slopewash has affected the original features and likely other cultural materials as well. Contents of surface-located features would presumably be affected the most by these processes, and may to some degree explain the downslope location of easily transported charcoal material such as and ash. This process may also have weathered features but left bone, FBR and lithic concentrations that are not as easily removed as the lighter organic remains.

Not all features have this downslope translocation pattern, so it may be presumed that human activity was still an influence in the overall patterns. Logically, occupants of the site would have preferred discarding debris downslope because it kept material from washing back down into their living area, or it was easier to work with gravity than against it. In layer 12, debris cleaned from features 44 and 47 were tossed outward from an apparent oval feature cluster, this may reflect keeping the center of a structure clear of debris.

Other patterns of feature, artifact and/or material associations are present. One correlation is the relation of rocks, not necessarily fire-broken, with burned and unburned bone concentrations. These suggest bone reduction or processing areas and do not necessarily correlate directly with recorded and easier defined features such as hearths or pits. Another pattern noted with lithic scatters is that many cores are marginal to the debitage concentrations and occasionally not even located in the debitage areas. Does this reflect an alternate use of cores as hammers, and an attempt in some cases to curate them for future reduction or some other behavior? An inspection of core varieties and specific locations can provide no single explanation. In some cases, cores found near features may have been curated and used as hammers. Some of these may also have been fresh materials brought to the site and perhaps set aside for later use. However, some small split pebbles are peripheral cores, that were not reduced to the extent that larger cobble and nodule cores were, and may have alternate use as wedges (e.g. *pièces esquilles*). Some peripheral cores are larger split cobble cores left to the side while the other half of the core was reduced into the dense chipped lithic debris concentrations. The reduced cores, or portions thereof, are commonly central to the densest concentrations but this is not always the case.

A common pattern is the location of utilized and/ or broken tools adjacent to hearths or in midden features. This is likely related to use, repair and making of tools. A hearth is required to harden wood, treat certain rock materials, prepare glues for use and provide warmth and light for working. This pattern is also common at other sites.

Unique tools, such as the grooved abrader in layer 13(1), the large limestone biface in layer 12, and the tipped/ notched unifacial tools, are located peripherally to the densest material concentrations. This may indicate that they were set aside for later use. All seem to be still functional items (to some degree) and indicate multipurpose uses. This may be an important aspect for many archaeologists to consider when focusing excavations on the most prolific areas of a site. Some valued or curated tools may be placed peripherally to the messiest areas, so that they could be found more easily when needed.

Possible bone tools are associated with a lithic concentration in layer 11, two cores in layer 12, and a large pointed/ hafted biface in layer 13(2). These associations may relate to pressure flaking functions for these bone tools in making or rejuvenating lithic tools.

Each layer provides cultural materials and patterns that are reflections of human habitation of this site between about 3000 and 5000 rcy B.P. Some similar patterns are noted between layers. However, each layer represents single or multiple occupations adapting to a similar environment during different historical situations..

Layer 8 seems to represent a habitation of a shallow pithouse structure with some associated processing activities to the southeast and southwest. The relatively sparse FBR, lithic and bone debris in the pithouse may actually support the interpretation of such a semipermanent structure. This is based on a survey of sedentary groups and more mobile gatherer-hunter groups' discard patterns by Murray (1980), which incorporates ethnographic data and ethnoarchaeological studies by Binford (1978), Schiffer (1975) and Yellen (1977). This may also be supported by other studies such as those of Kent (1984) and Schiffer (1987: 47-98). From this general comparative information, a semipermanent structure or dwelling is quite likely to be kept clear of debris. However, adjacent to the dwelling other "outside" activity areas are common, and intense accumulations of debris are generally located beyond these. This appears to fit the sparse materials associated with the pithouse and the adjacent activity areas. Greater refuse accumulations, based on this model, are likely to be in the vicinity. This may also suggest that this habitation structure was returned to and reutilized. This is supported by the complex re-use of features within the pithouse, multiple occupation layers (at least two to three), the general dispersion of cultural materials, and a spring/summer and a fall/winter seasonality. A variety of fauna may also support a prolonged and/or reoccupation habitation pattern.

Layer 9 distribution patterns indicated two to three possible activity loci. These appear to have been heavily disrupted by natural processes. A few faunal remains, sparse but heavily utilized FBR and some preliminary lithic reduction suggest a short occupation. However, this may be a reflection of natural processes removing materials from this layer. The intermittent strata, unrecognized features and weathering of bone support this. Thus, interpretation of this layer is considerably limited.

Layer 10 has a considerable amount of bone material relative to a sparse amount of lithic debris. A moderate use of FBR is indicated. Two mature bison, a large canid and a red fox are the only larger fauna represented. The bison skull feature in layer 10 is intriguing. Placement of an additional set of nasal bones with the nearly complete skull is evidently purposeful. The skull faces south-southeast and the only hearth in this layer is immediately to the southeast of the skull. These relationships may be significant. The skull is upside-down and the base is smashed. This may indicate removal of the brains. Bison brains are known to have been used in tanning hides (e.g. Grinnell 1977: 216; Lowie 1985: 74). The nearby hearth has an accumulation of pebbles adjacent to it. Pebbles may have been gathered for use in a sling for getting smaller game. However, only two rodents are represented in the small fauna. Two unifacial tools, one notched and tipped, are located adjacent to the hearth. A core and reduction debris are just to the northwest, associated with the highest bison material concentrations. Perhaps some of these flakes were used in dismembering the bison killed on or near this area. However, no use-wear is apparent on these flakes. Fewer limb elements are represented, while axial and skull elements pervade. This suggests removal of the more valued meat and marrow-rich remains to a camp or processing area. This may represent initial butchering activities following a nearby kill event. The basin provides topographic conditions for ambushing animals coming to water at the river. We can speculate that the hearth was used to keep warm and provide light while the carcasses were being butchered. The gathered stones may have been collected to toss at scavenging animals. The canids may represent a few scavengers who did not get away. The bison skull may have been placed by chance while people were busying themselves about the small hearth, but it may also hold some religious or spiritual.importance. All ethnographic studies of Great Plains peoples reflect a common theme of reverence for the bison and this general belief was likely not much different at that time.

Layer 11 contains sixteen features which correlate with cultural material in three main clusters. A cluster of five hearths between 123N 110E to 123N 107E and 122N 108E to 124N 108E reflect a possible habitation structure (see Figure 7.26). Lithic debris, excluding cores, is concentrated at the southern margins of this oval area. This suggests biface reduction and later stages of tool production. Indeed a biface, bone tool and anvil are in this concentration. Bone and FBR are also within this area, though the northern and northeastern margins have less debris. Peripheral to this oval area are a Hanna type point and a uniface. A variety of fauna is present. Cutmarks are present on a canid humerus which suggests that the skin and/or meat were utilized. Immediately to the southeast of this oval area is another feature and material locus. This includes a basin hearth and midden debris. A smooth surface rock is associated with this locus and may have been used in processing food. A smaller hearth feature cluster centering on unit 123N 113E is associated primarily with a core reduction activity. This habitation pattern reflects a mobile gatherer-hunter lifestyle which is predominant on the plains, as suggested by the debris accumulation within a temporary dwelling (see Murray 1980).

The immature bison suggests a spring/summer seasonality for this occupation. Feature 2/G, a basin hearth associated with the midden area, and 5/C, a multiple hearth within the oval (possible structure) area have flotation data available. *Chenopodium* and cf. Labiatae are present in this feature and may have been used for food (Densmore 1974; Shay 1980). However, these plants are also common in the area and may have inadvertently been incorporated into the hearth (Tom Shay, personal communication, February 8, 1993; Benn 1990:194-195). Charcoal from.this hearth was identified as cf. *Populus / Salix.*

The basin hearth in the midden area contains a wider variety and greater number of seed remains and charcoal. The charcoal identified includes cf. *Populus*, cf. *Populus / Salix* and hardwood. *Chenopodium, Prunus sp., Rosa sp., Symphoricarpos sp.*, cf. Compositae and several other unidentifiable whole and fragmented seeds are present. Though many of these are used for food, beverages and seasoning, three of these have medicinal use (Densmore 1974; Shay 1980; Zoltai 1989). *Symphoricarpos sp.* is well represented and has only a medicinal value recognized (Densmore 1974). All these plant remains may suggest a summer seasonality.

Layer 12 has a similar pattern to layer 11. A cluster of seven hearths and associated ash and charcoal features are concentrated in an oval area spanning 122N 109E to 123N 106E and 121N 107E to 124N 110E. Other cultural material patterns, with the nearby midden area to the southeast suggest a possible temporary structure around this oval area. Burned bone is highly concentrated throughout, perhaps used as fuel in hearths. However, it is most concentrated in a midden area to the southeast. This midden area also has the highest amount of FBR, chipped lithic debris, core and broken tools. Broken tools include various pointed and hafted tools which are Hanna-like in shape, but seem to have been reworked and utilized as knives. Lithics are also concentrated along the southern part of the oval area, but are less frequent in the northern half. FBR is present in the oval area but is sparse in the northeastern and central parts. Other outside features, a hearth in 121N 105E and a pit/hearth in 121N 112E, reflect other nearby activity loci. A substantial, either intense or long occupation is suggested by the total amount of faunal, chipped lithic and heavily used FBR remains.

The midden area is centered on a pit in unit 121N 110E. Flotation samples submitted from this feature are separated into an upper and lower portion (4/A and 4/B). Charcoal from both of these include cf. *Populus* and hardwood, but 4/B also contains a conifer. Conifers were not in this area in recent precontact times and may represent importation of this wood or a rebound/extension of the conifers southward during the Sub-Boreal climatic period. *Chenopodium* seeds are present in both samples; however, 4/A also contains cf. Labiatae. Both of these are useful as food, and if used may suggest a late summer/early fall seasonality.

Another pit/hearth feature has flotation data for layer 12. Feature 3/F is located downslope from the oval concentration area and midden concentration. It contained some unidentifiable charcoal and one whole unidentified seed.

Layer 13 has been subdivided into four sublayers that are apparent in most areas of the block excavation and were separated by both natural and arbitrary levels. Layer 13(1) contains two mature bison and an immature bison that suggests a summer seasonality. Probable robin remains may also support a summer seasonality. Feature locations and material distributions suggest two main activity loci that overlap considerably. Burned bone is associated with both clusters, as is extensively reduced FBR. Ten cores and considerable lithic debris indicate lithic reduction and tool rejuvenation as dominant activities. A large hafted and pointed Hanna-like biface is present in this layer, associated with the mid-block focus. Another biface is also nearby. Marginal to the lithic and burned bone debris, but adjacent to hearth feature 65 are a marginally retouched tool and a grooved abrader. The abrader may have been used in straightening wooden shafts and/or sharpening bone or antler knapping tools. Either interpretation may fit the focus on lithic knapping activities in this occupation. A pit, feature 66, containing an upright bison ulna, bone fragments and FBR may reflect a processing pit later filled with refuse. A large rock placed over the top of it may also suggest use as a cache pit.

Layer 13(2) has a considerable amount of bone and burned bone that is concentrated in the lower half of the excavation block. This concentration is generally associated with the five features present in this layer. Considerable amounts of burned bone, bone, well-used FBR and charcoal is associated with hearth 59a and a nearby charcoal concentration, feature 62. Fauna includes two mature and one immature bison, in addition to two rabbits, a mink and a mid-sized canid. Lithic material is scattered about the two hearth features 1 and 7, as well as a denser concentration upslope. Five cores are associated with the downslope lithic activity and three unifaces and a marginally retouched tool indicate use on medium to hard materials such as wood or bone. Two of the six cores have multiple platforms, and shatter and flake debris is nearly equal. This may reflect both bifacial preparation and general reduction. Two point base fragments of the McKean Lanceolate and McKean/Duncan types are also here. These materials may reflect activities associated with the repair of spear shafts and projectile point tips. Farther upslope, a smooth-surfaced stone may also have been used in these activities, or for food preparation. A large, pointed biface tip is upslope near a bone tool and adjacent to a small charcoal feature 60. Another core and marginally retouched tool are also in this mid-block area.

Flotation analyses of hearth feature 7/E revealed a variety of porous and hardwood charcoal. Seed remains included *Potentilla sp*., *Prunus sp*., cf. *Iva sp*. and other unidentified seed fragments. These plants were generally used as food and condiments in precontact times (Shay 1980; Zoltai 1989). These plants are available in late summer to early fall, and this may be suggested as the season of occupation, although these plants may be stored for use in different seasons.

Layer 13(3) has fewer faunal remains, including a mature bison and a coyote-sized canid. The canid tarsal bones are burned, possibly indicating use as food. A single large pointed biface tip represents the only tool. It is located with a core at the hearth, feature 59b. Slightly higher amounts of bone, burned bone and moderately used FBR are also in this area. A few other moderate bone, burned bone and FBR accumulations upslope are associated with a diffuse cluster of lithic debitage and two cores. Debitage includes nearly equal numbers of shatter to flakes, and contains noticeable amounts of resharpening flakes and cortex. Another cluster of lithics, bone, burned bone and FBR is noted in the northeast corner of the block. These indicate a range of lithic reduction and rejuvenation/reworking activity as well as other subsistence activities.

Layer 13(4) contains three features in a sparser faunal and lithic layer. Fire-broken rock is minimally present and reflects little use, perhaps suggesting a short duration of site occupation. Bone, burned bone, lithic debitage, tools and FBR are strongly associated with feature 6, a large hearth, and a nearby small hearth (feature 61). A chopper/hammer, biface fragment and two cores are about the large hearth, and another core and two points are near the small hearth. Flakes outnumber shatter 2:1 and the cores are minimally reduced. Bifacial thinning may be a more dominant lithic activity. Four bifaces are represented in the layer, including two McKean Lanceolate points. Flotation data from the large hearth, feature 6/D produced diffuse porous charcoal, but also contained *Chenopodium sp., Rosa sp.*, a nut shell fragment and 10 other unidentifiable seed fragments. These are potential foods and are available during summer to late fall (Densmore 1974; Shay 1980; Zoltai 1989).

Feature 64 downslope is another small hearth area which has a biface fragment near it. A nearby concentration of bone and burned bone has a hammerstone central to it. A mature bison and approximately one-month old immature bison is represented. A crow(?) (*Corvidae*) and mallard duck are present in this layer as well. Both the floral and faunal data suggest a spring/summer seasonality for the occupation.

Layer 14 is composed of at least three main sublayers. These are separated by natural sublayers and by arbitrary levels. The diffuse nature of the natural sublayers makes the separation of these layers more tentative. Some separation is possible, but this layer is treated mostly as a single unit. It should be noted that this may represent at least three limited occupations.

Though no features are recorded for this layer, two bone reduction areas are suggested by stone and bone debris concentrations. These occur at the east end of the block area. Some well-used FBR is represented in two clusters. One cluster is in the southeast corner of the block and is associated with the bone debris; however, the other is located mid-block with moderate bone debris associations. Midway between these FBR concentrations are two cores, central to a dispersed accumulation of lithic debris. Cortex numbers are high and flakes outnumber shatter about 2:1. This suggests initial core reduction, perhaps to use flakes as tools, or in preparing biface preforms. However, no diagnostic tools or utilized flakes are found in this layer. Identified fauna include a mature bison and a deer in layer 14(1). A mature bison, an immature bison (about three weeks old), a mature deer and a jackrabbit are represented in layer 14(2). A female mature bison is represented in layer 14(3). The immature bison in layer 14(2) suggests a spring seasonality for this occupation.

Layer 15 has few materials represented because of its limited excavation area. No FBR is present. Debitage is rare and equally divided between flakes and shatter. Bone is present, and in lower sublayers burned bone is present. Further excavation is required to reveal patterns or material culture affiliations for these lower occupations.

CHAPTER 8

Comparisons of McKean Sites

8.1) Introduction

The Redtail site has a local sequence of McKean occupations. The intrasite distributions and data indicate that small groups returned to the same site over many generations. Some assemblages seem to represent a short occupation while others seem to represent occupations that span more than one season. This latter case may reflect re-occupation during different seasons. Other nearby sites with McKean assemblages can support or add to this interpretation of the general lifeway pattern.

Two nearby stratified McKean occupations include the Cactus Flower (EbOp-16) and Crown (FhNa-86) sites. These sites, with Redtail, provide the best evidence of McKean variation through time in this region because of the stratigraphic temporal subdivision of material cultural. Thus, these form the basis for detailed systematic comparisons. Other local McKean sites are also discussed. They provide additional contextual evidence to compare with these three foci and provide perspectives from other riverine and some nonriverine site locations.

Site comparisons of McKean materials from across the Plains are difficult, because of the fact that McKean studies span the last 57 years and are distributed over a more diverse geographical area. This results in dissimilarity, and sometimes incompatible analytical approaches and data for detailed comparisons. However, the greatest problem is the lack of published information on many sites, and poor access to information across international, interprovinicial and interstate boundaries. A general discussion of McKean across wider geographical locations is presented in Chapter 3. A chronology-oriented review of McKean is provided near the end of this chapter. Calibrated radiocarbon dates for McKean sites across the Plains are presented and the timespans of McKean in different regions across the Plains are discussed.

8.2) Comparative Methodology

Most archaeological studies assume that there are site types which are generally based on primary functions that fit into discrete categories. Dyck (1983: 5- 20) outlines general categories including habitations, kills, quarries, burials, rock art, boulder alignment, trade centers and agricultural sites. On the other hand, Siversten (1980) combines several models to develop a classification for re-evaluating Early Precontact period "kill" sites. Unlike the traditional categories that are based almost entirely on judgmental inferences, her's are based on a broader range of consistent and more objective criteria. Her site type attributes include aspects of the bone density, degree of bone articulation, fragmentation and the concentration or dispersion of bone, the amount and variation of lithic material types and tools, the relative amount of debitage present, the range of faunal species represented, site environment and topographic location. A comparative framework, similar to Siversten's (1980) approach, includes feature types, other lithic and faunal attributes, as well as excavation methods (see Appendix B, Table 1). The Cactus Flower, Crown and Redtail sites are compared within this framework.

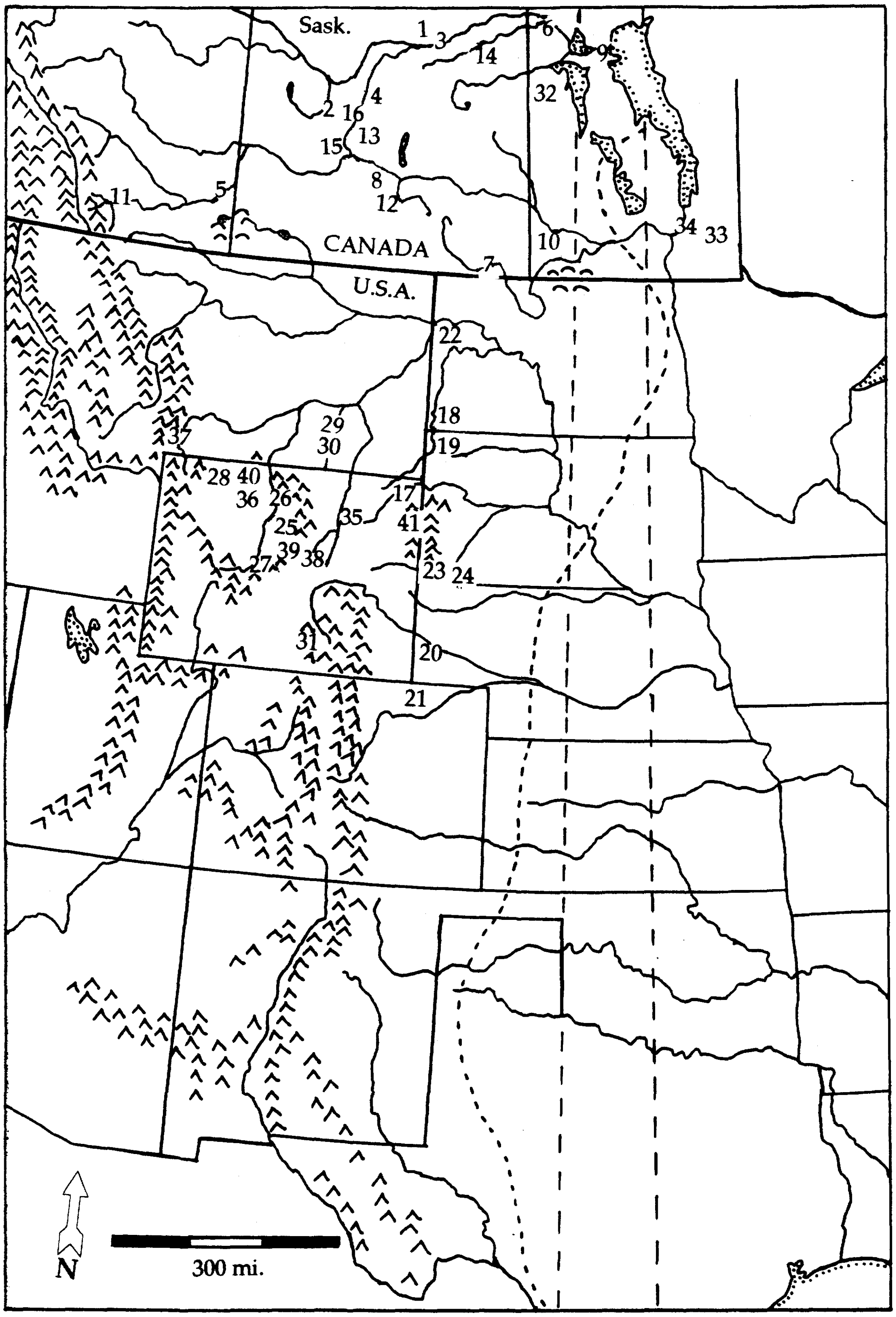
Calibrated radiocarbon dates are presented from several McKean sites from across the Plains to review timespans in different areas. Calibrations are based on two sets of calibration curves (Pearson and Stuiver 1986; Pearson *et al.* 1986) used in a computer program from Stuiver and Reimer (1987). Pearson and Stuiver's (1986) calibration curve, with a 10 year interval resolution, is used on dates with the older two sigma values that are more recent than 4020 rcy B.P. Pearson *et al.*"s (1986) calibration curve, with a 20 year interval resolution, is used for dates with older two sigma values that exceed 4020 rcy B.P. These dates are presented as two sigma calibrated ranges in a sequence of regional and local groupings. The two sigma ranges from different areas are compared graphically for overall age ranges, with some assessment of varying point type associations within these ranges. Discussions of sites in the study area use the un-calibrated radiocarbon years (rcy) B.P. designation, and calibrated dates in the general chronology-oriented discussion are designated calibrated years ago (cya).

8.3) Study Area comparisons

8.3.1) Comparisons of three stratified McKean component sites

Just across the Saskatchewan-Alberta border, in the South Saskatchewan River valley, is the best stratified sequence of McKean occupations on the entire Plains. This is the Cactus Flower site (EbOp-16), located on a 6 m to 15 m high terrace of an oxbow flat. Northeast of the Redtail site in the Saskatchewan River valley is the Crown site. The Crown site (FhNa-86) is located on a small terrace at the confluence of a small tributary and the Saskatchewan River. Comparative aspects of the Cactus Flower, Crown and Redtail sites are presented in Appendix B, Tables 2, 3 and 4 respectively. These sites and the other sites used for comparison are discussed in this chapter, and are presented in Figure 8.1 and in Table 8.1.

The Crown site, at the time of McKean occupations, was near the margins of transition between parkland and mixed-wood forest. The Redtail site is, and probably was, located in a transitional area between mixed-grass prairie and parkland ecodistricts. The Cactus Flower site is in a less transitional region, but is in the short-grass prairie ecodistrict near the margins of the mixed-grass prairie ecodistrict. The common factor of these three locations is that each has access to two major ecodistricts as well as to the plentiful resources of the riparian complex of the South Saskatchewan and Saskatchewan Rivers. All three of these



From: Plowden (1972)

Figure 8.1 Plains McKean sites

Table 8.1 Plains McKean sites depicted in Figure 8.1

Figure 8.1 reference #	Site name	Site Borden or number	Reference(s)
1	Broken Axle	FhNc-81	Finnigan et al. 1983
2	Billett	EkNv-36	Dyck 1983
3	Crown	FhNa-86	Quigg 1986
4	Redtail	FbNp-10	present study
5	Cactus Flower	EbOp-16	Brumley 1975
6	The Pas Reserve	FlMh-2	Tamplin 1977
7	Long Creek	DgMr-1	Wettlaufer and Mayer Oakes 1960
8	Mortlach	EcNl-1	Wettlaufer 1955
9	Tailrace Bay	GRS-3	Mayer-Oakes 1970
10	Cherry Point	DkMe-10	Haug 1976
11	Cranford	DlPb-2	Stuart 1990
12	Big Kill	EbNj-2	Dyck 1983
13	Sullivan	EjNr-1	Johnson 1975
14	Connell Creek	FhMu-1	Dyck 1983
15	Sjovold	EiNs-4	Dyck 1983
16	Graham	FaNq-30	Walker 1984
17	McKean	48CK7	Mulloy 1954; Kornfeld and Frison 1990
18	Red Fox	32BO213	Syms 1969
19	Lightning Spring	39HN204	Keyser 1985
20	Signal Butte	?	Forbis et al. n.d
21	Dipper Gap	5GL101	Frison 1991
22	Mondrian Tree	?	Frison 1991
23	George Hey	39FA302	Frison 1991
24	Kolterman	39FA68	Wheeler 1985
25	Leigh Cave	48WA304	Frison and Huseas 1968
26	Granite Creek Rockshelter	48BH330	Frison 1991
27	Wedding of the Waters	48HO301	Frison 1962
28	Dead Indian	48PA551	Frison and Walker 1985
29	Dodge	24RB1225	Davis 1976
30	No name	24RB1164	Munson 1990
31	Scoggin	48CR304	Lobdell 1974
32	Filuk	?	Syms 1969
33	Cemetery Point	?	Syms 1969
34	Larter	?	Syms 1969
35	Cordero Mine	48CA75	Frison 1991
36	Bottleneck Cave IV	48BH206	Husted 1969
37	Riggler Bluffs	24PA401	Syms 1969
38	Grey-Taylor	48JO303	Syms 1969
39	Medicine Lodge Creek	48BH499	Frison 1991
40	Mummy Cave I	48PA201	Frison 1991
41	Hawken II	48CK303	Frison 1991
42	Gant	39ME9	Gant and Hurt 1965

sites have several radiocarbon dates associated with multiple McKean occupations that span the period from 4300 to 3300 rcy B.P.

The stratigraphic separation at the Crown site was difficult (Quigg 1986: 19-28). Excavations here were part of mitigative work associated with the construction of the Francois-Finlay Hydroelectric dam. Field provenience was less refined, consisting of 1 m^2 horizontal resolution and 10 cm arbitrary vertical levels which attempted to follow natural soil layers (Quigg 1986: 9). A lower "McKean component" and an upper "Hanna component" were recognized in addition to an uppermost Late Precontact period component. Two to three occupations are associated with the McKean component. These are below, and separated from, three to four Hanna component occupations by between 5 cm to 30 cm of soil which contains an undiagnostic "sterile" occupation. Excavations include a connected eastern block and western block, with generally better separation of layers in the east block farther down slope. Overall, the stratigraphic development has similarities to the Redtail site. It seems to have had generally similar deposition/erosion influences which resulted in poorly developed organic horizons in predominantly alluvial deposits, with some other river and creek flood modifications.

Seven radiocarbon dates on bone samples from the Crown site indicate a span from 3610 $\pm$105 rcy B.P. (S-2524) to 4330 $\pm$115 rcy B.P.(S-2520) for the McKean component. The identified Hanna component spans 3300 $\pm$110 rcy B.P.(S-2292) to 3605 $\pm$120 rcy B.P.(S-2556) on the basis of four bone sample dates. One date (S-2557) from an elk antler tine is omitted from this span by Quigg (1986: 32) because it was too recent. A second date S-2524 was rejected by Quigg (1986: 33) but is considered acceptable here, in agreement with Morlan's recent (1993: 33) assessment. Morlan (1993: 32-33) also correlated these several dates with excavated levels and point types. These correlations suggest that the separation of the McKean and Hanna components is not as clear as Quigg (1986) purports.

The Cactus Flower site contains eight occupations (III to X) that are identified as McKean. A stratigraphic grouping of occupations, (numbers VIII, IX and X) is depicted in the profile from one of the main excavation blocks, X.U. 1 (Brumley 1975: 10-11 and 136). Two charcoal samples from Occupation VIII indicate fairly consistent dates of 4130 ±85 rcy B.P. (S-782) and 4220 ±130 rcy B.P. (S-1210).

Occupation VII appears to be well separated from other occupations above and below. No dates were obtained for it. Occupations IV, V and VI appear to be more closely associated in the profile (Brumley 1975: 136). Two dates from layer IV, one on a charcoal sample, 3620 ±95 rcy B.P. (S-822), and another on a bone sample, 3675 ±80 rcy B.P. (S-784), are consistent. Two dates from Occupation VI include a charcoal sample dated 3615 ±95 rcy B.P. (S-823) and a bone sample dated 3890 ±160 rcy B.P. (S-890). These are less consistent but do overlap with two sigma ranges.

The uppermost components, Occupation III appears fairly well separated from the layers above and below (see Brumley 1975: 136). A charcoal sample dated to 3740 ±100 rcy B.P. (S-1209) and appears to be too old when compared to the other dates. Occupations I and II at the Cactus Flower site are close together (Brumley 1975: 136). The uppermost of these occupations produced corner-notched Pelican Lake type points.

The excavations are primarily concentrated in two separated large excavation blocks (X.U. 1 and X.U. 6) and another smaller block (X.U. 5). These are tied together by intermittent tests (X.U. 2, X.U. 3 and X.U. 4) and strata traced along the exposed cutbank (Brumley 1975: 10-11 and 135). Horizontal provenience is recorded in 50 cm by 50 cm quadrants within 1 m^2 or 2 m^2 units, that were excavated primarily in 10 cm arbitrary levels (Brumley 1975: 7-13). The strata are consist of a combination of point bar, flood and aeolian deposits (Brumley 1975: 12). The depth, substance of these layers and their location of these layers suggest that floods were the primary geomorphic agents at the site. Brumley (1975: 12) noted the presence of bone remains between the main cultural occupation layers denoted at the site. This suggests that other minor occupations are between the major recognized occupations, or that post-depositional processes (e.g. fluvial) have redeposited materials in these layers.

The Redtail site stratigraphy and dates are presented in Chapter 4. There are obvious stratigraphic problems here caused by the alluvial, colluvial and possibly fluvial influences on the strata. However, careful excavation and detailed separations have retrieved some meaningful comparative data from the McKean occupations associated with layers 10, 11, 12 and the four sublayers of layer 13. It is possible that layers 8, 9 and/or 14 are McKean.

Chipped Lithic Tool Comparisons

Projectile points are among the most useful diagnostic items present, even if they are not as numerous at these sites as is necessary for statistical analyses. At the Redtail site at least three McKean Lanceolate points are present in layers 13(2) and 13(4) (see Appendix B, Table 4). Two to three Hanna-like points and a possible Duncan point base are present in layers 11 and 12. Also, in layer 12 a base fragment, a neck fragment and a complete point indicate varying degrees of side-notching. Two of these side-notched points and a Hanna-like point have straight or slightly convex bases.

At the Crown site seven McKean Lanceolate points are identified with the lower McKean component (Appendix B, Table 3). Two other point fragments indicate a similar style but identification is indeterminate (see Quigg 1986: 61). In the upper Hanna component seven Hanna-like points are present (Quigg 1986:

Figure 6.6 #'s 5, 7, 8, 9, 10, 11 and 17). Three of these are more side-notched and most have straight to slightly convex bases. Two of the seven appear to have an incidental, or a single small random chip removed from the base. Two other "points" depicted may also be Hanna-like but are small (#6) or are minimally shaped from a flake (#18) (Quigg 1986: Figure 6.6). Two points appear more Duncan-like and another is McKean Lanceolate-like or it could be a preform or knife (Quigg 1986: Figure 6.6: #'s 12, 16 and 15 respectively). One point is identified as a Mummy Cave (Bitterroot) point (#20), and another incomplete specimen may also be one of these early side-notched point varieties (#14) (Quigg 1986: Figure 6.6). Four other point bases are broken: one is broken across a corner-notched neck, another across a side-notched neck and two are broken across more stem-like bases (Quigg 1986: Figure 6.6 #'s 1, 2, 3, and 4 respectively). Another specimen broken across the body is of an indeterminate type and is larger than most other point specimens. The size suggests it may not have functioned as a projectile point, but it may be a larger biface tool or point preform (Quigg 1986: Figure 6.6 # 13). An Oxbow type point is also recovered from this component (Quigg 1986: Figure 6.6 # 19). This does not appear to be a typologically clear "Hanna component" as Quigg (1986) indicates. Besides the typological uncertainty there appears to be stratigraphic mixing of McKean Lanceolate and Hanna-like points in several levels within the same blocks (Morlan 1993: 32-33). Perhaps these projectile point's arbitrary level proveniences are corrected to the natural soil layers? Some of the point variation may be explained by rejuvenation or re-use of these tools in varying functions, such as knives. However, some differences are stylistic, and older points, such as Bitterroot and Oxbow, were likely picked up and reused by these occupants.

At the Cactus Flower site, 4 McKean Lanceolate, 11 Duncan and 9 Hanna points were identified. The relationships of these point types to the occupation levels are presented in Appendix B, Table 2. Three of the four McKean Lanceolate points display slight constricting of the sides toward the base (Brumley 1975: Plate 15, letters A, B and D). The fourth McKean Lanceolate point appears to have been rejuvenated forming somewhat sinuous edges (Brumley 1975: Plate 15, letter C). This point may have been a stemmed variant prior to this rejuvenation.

Though I can agree with most of Brumley's (1975: 163) identifications of Duncan and Hanna points, I believe that there may be some problems in typing reworked/rejuvenated specimens. Points L, M, N, O, P, R, W and X(?) appear to have been reworked and this influences how they are categorized into specific Duncan or Hanna types (see Brumley 1975: Plate 15). Two specimens, Q and S, identified as Hanna may be more tentatively classified because they seem to have been shaped for use as knives rather than as projectile points. They have broad, rounded body forms with an obtuse angled tip in planview, or no tip, and both have more notch-like haft areas. Brumley (1975: 38-39) also notes that specimens F.S. 1286-2, F.S. 198-1 and 453-1 are recognized as "points" that have been modified, and likely served functions quite different from projectile points.

Some of the more complete points have been rejuvenated, and this also influences how they have been classified (see Keyser 1982; Towner and Warburton 1990). For example, consider the point "T" in Brumley (1975: Plate 15), identified as a Hanna type. "H" is identified as a Duncan but the base is nearly identical in shape to "T", as well as "W" which is also identified as Hanna. Both stems of "T" and "H" expand toward the base by 2 mm overall. The difference is that "H" has had its body and edges rejuvenated. This has resulted in a 4 mm difference in shoulder to stem minimum width for specimen H, and an 8 mm difference for "T". The consequence of rejuvenation could make original Hanna point types Duncan-like and original Duncan points McKean Lanceolate-like. Brumley's (1975: 38-39) criteria (based on Wheeler 1954: 7-13) of obtuse versus more acute shoulder angles was applied in this case to separate them into Duncan and Hanna types. Though I prefer to emphasize the expanding stem versus the parallel stemmed criteria to separate Duncan and Hanna, I still recognize that it is not adequate for consistent separation. By recognizing rejuvenated points the identifications should be more tentative. The consequence of these observations is that some points identified as Hanna, Duncan and McKean Lanceolate are rejuvenated, modified or may be different tools altogether. The question is, how comparable are haft characteristics for typing between these different modifications and tool types? This greater range of functional uses for "points" may be a major factor in the apparent type variation in McKean points. This may be generally similar to the explanation of functional variability that Allyson Ramsay (1991) has postulated for Besant point variation.

Perhaps simply separating the stemmed points from the lanceolate points may seem a more consistent approach, as Frison and Walker (1984) have done. However, some Hanna points may be even better classified as open corner-notched. Such simple classifications *again* focus on morphology and ignore the technological and functional aspects to a large degree. Stylistically similar types can always be grouped or lumped together, if that is preferred, but points identified as "stemmed," cannot be separated into known types and are thus less useful for comparisons.

Five stemmed or basally notched proximal point fragments are also noted at the Cactus Flower site. These are classified as either McKean Lanceolate, Duncan or Hanna types (Brumley 1975: 40). At least two or three of these could be identified as McKean Lanceolate or Duncan, but probably not Hanna (see Brumley 1975: Plate 16, letters I and J). Brumley (1975) does not provide stratigraphic provenience for specific specimens. Thus, it is impossible to ascertain which occupations these specimens came from. This is also the case for the more complete points identified. Hence, any proposed alterations of point typing can not be correlated with the stratigraphic profile.

At the Redtail site a complete large pointed biface is present in layer 13(1) and the base of a large thick hafted biface is in layer 12. Three pointed tips also seem to be from larger bifaces (see Appendix B, Table 4). At the Crown site two such large side-notched hafted bifaces are present in the lower McKean component. Seven large hafted bifaces are present in the upper Hanna component. One or to two of these seven have a stemmed haft area while two to five may have side-notched haft areas (see Quigg 1986: Figure 6.8, #'s 1, 2, 3, 4, 7, 10 and 11 respectively). The uncertainty is due to ascertaining these attributes from photos. Four large hafted bifaces are present in Occupations VII and VIII at the Cactus Flower site (see Appendix B, Table 2). Another was found on the surface but is not differentiated from the other specimens presented. All are side-notched and only one is complete. Two from the Crown site have stemmed bases that are parallel or constricting towards the base. One of these has a straight base and the other an irregular convex base (although corners may be broken off a straight base). These items are likely too large to have been used as points for throwing spears. It is possible that they were used as thrusting spears or as hafted knives.

A search for pointed bifaces, ovate-rectangular bifaces and irregular bifaces should relate the stages of bifacial preform production at different occupations in these sites. The Redtail site had only one ovate biface in layer 11. General lithic core reduction is indicated in most other layers. However, biface production may be indicated in the debitage analyses of some layers (e.g. greater amount of flakes to shatter and the higher biface index).

At the Crown site five pointed bifaces were present in the McKean component (see Quigg 1986: Figure 4.11, #'s 5, 6, 7, 8 and 9). Also, at least two smaller ovate forms and 14 other irregular and presumably fragmentary bifaces are present. In the Hanna component at least four ovate bifaces are documented as well as 25 other irregular and fragmentary biface pieces. Interestingly, two fragments fit together to form the exterior edge of an ovate biface (see Quigg 1986: Figure 6.8, #14). These fragments had been removed from a larger ovate blank or preform to produce a more refined biface.

The Cactus Flower site contains 9 pointed bifaces, 13 ovate/rectangular bifaces and 5 irregular bifaces. Provenience data for these is presented in Appendix B, Table 2. Biface manufacturing is indicated in Occupations IV, VI, VII, VIII and IX. All of these occupations have between two to four ovate/rectangular biface nodules. Occupation VIII has most of the biface production materials and is dominated by six pointed biface preforms in late production stages, though the complete sequence is present. Three occupations, III, V and X, indicate a lack of these stages of biface production, similar to the Redtail site layers.

Unifaces include endscrapers, side-scrapers, hafted and unhafted spokeshaves, hafted pointed unifaces (flake points), blade-like forms, gravers or tipped tools and notched tools. At the Redtail site a small parallel-sided pebble side-scraper is recorded in layer 10. A single tertiary flake endscraper from layer 13(2) is slightly convex on both the dorsal and ventral surfaces, and is triangular in outline. Two hafted and pointed unifaces are present in layer 12. One is quite small, and both are Hanna-like in outline. A blade-like unifacial tool is present in each of layers 11 and 13(1). Graver or tipped tools are present in layers 10, 11, 12 and 13(2).

The Crown site has 30 endscrapers (Appendix B, Table 3). Twelve are in the McKean component and eighteen in the Hanna component. It may be worth noting that 10 of the 12 McKean component endscrapers are made from tertiary flake forms and one is made on a secondary flake. Two of the Hanna component's 10 endscrapers are made from tertiary flakes, 5 from secondary and 3 from primary flakes. One and possibly two spokeshaves are noted in the Hanna component (see Quigg 1986: Figure 6.11, #14 and 17 respectively). These may have had proximally constricted stems and convex bases. Two flake points were noted previously in the discussion on projectile points from the Hanna component. An alternating unifacial retouched blade-like specimen is present in the Hanna component (Quigg 1986: Figure 6.13, #10). One or two tipped tools may be present in the McKean component, but it is too difficult to distinguish the salient features of marginally retouched tools from the photographs.

The Cactus Flower site has 27 endscrapers represented in assemblages from Occupations IV through IX. Eight are in Occupation VIII, five are in each of Occupations VI and IX and three are in each of the remaining three occupations. Sixteen of the 27 endscrapers are triangular in outline and many of these appear to be made from tertiary or secondary flakes. Nine endscrapers have parallel sides and are most commonly on primary flakes. Several are made from pebbles (see Brumley 1975: 48-50, 124 and Plate 25). Three hafted spokeshaves are present, two in Occupation VIII and one in Occupation IV. While the Crown site specimens generally have stemmed hafts, two of these are more side-notched, and a third has an expanding stem or broad corner notches. Like the Crown site specimens, the large spokeshave notch is opened to the left side, presuming that specimens are oriented dorsal surface up. One of the Cactus Flower specimens has concavities on both sides of its working edge, although the right side is poorly retouched in this case (Brumley 1975: 50-51, 124 and Plate 26, letters C, D and E). Another notched spokeshave is also present in Occupation IV. Three gravers or tipped tools are identified in occupations VII, VIII and IX. The uppermost occupation has a "castellated" graver (which has intersecting, straight, unifacially retouched edges which produce a tipped corner) while the latter two occupations have "tit" gravers (see Brumley 1975: 52, 125 and Plate 26). A notched flake is present in Occupation IV. Two blade-like retouched flakes are shown in the marginally retouched tool photographic plates. One of these is from one of the three upper to middle McKean occupations (see Brumley 1975: Plate 24, letter I).

A variety of cores are present at the Redtail site (Appendix B Table 4). Layers 12, 13(1) and 13(2) have the most lithic core reduction. Many of the bifacial cores identified at the Redtail site are reduced bifacial nodules, and are analogous to what Brumley (1975) identifies as crude bifaces and possibly some irregular bifaces (Brumley 1975: Plate 19, letters B to H and Plate 20). Although some cores are utilized as bifacial chopper tools they may also indicate production of flakes for use. Some bipolar and split pebble cores may have been used as wedge tools, and thus have a specific function different from other cores (see "*pièces esquilles*" in Brumley 1975: 53-54).

Crown site cores are listed in Appendix B, Table 3. The Hanna component contains 11 bipolar, 6 multiple platforms, and 16 single platform cores. The McKean component contains 13 bipolar, 15 multiple platform and 15 single platform cores. Some of the bipolar cores may have been used as wedge tools, and the relative number of multiple platform cores is used to interpret more core reduction. Thus, the McKean component seems to have more cores, as well as a higher degree of core usage than the Hanna component.

The Cactus Flower site McKean occupations have 61 pebble cores, of which 56 are identified as wedge tools or *pièces esquilles* (Brumley 1975: 52-54).

Presumably these may have functioned in splitting wood or bone, but use-wear and experimental studies of these tools on the Plains are lacking. Bifacial cores (equivalent to the "crude biface" category) include at least 21 specimens (Brumley 1975: 42-43). Occupation VIII contains 15 of these specimens. This may indicate that this type of core reduction was a dominant activity in this occupation (Appendix B, Table 2). A category here called cobble cores, is roughly equivalent to Brumley's (1975: 57) heavy chipped stone tool subgroup's 5 and 6, and contains 22 specimens. Ten of these are in occupation VI and five are in each of occupation IV and VIII. The use of coarser core materials may reflect activities requiring more durable and larger flake tools/ core tools at these occupations.

Large Granular Tools

This category generally includes hammerstones, anvils, and choppers, in addition to abraded, ground or smoothed stone items. Hammers and anvils (often dual use items) are the predominant tools in this category at the Redtail site. These items occur with split pebble/ bipolar cores and general lithic reduction in layer 12 but not in layers 8, 11 and 13(4). One of the hammer/ anvils in layer 8 had become a FBR and may have been removed from its original anvil/ hammer use location. This may be the case with other items, but they may also have had multipurpose uses in bone reduction for marrow extraction, pemmican and food production, or hide processing (see Adams 1988). The chopper tools would likely be more efficient in bone reduction or wood splitting. Some stones with smooted surfaces may have been used for wood abrading, sharpening bone or antler knapping tools, or processing animal hides and plant remains (see Flenniken and Ozbun 1988: 37-52). A grooved abrader may have been used as a wood shaft smoothing tool or as a sharpener for bone or antler flint knapping tools (see Flenniken and Ozbun 1988: 37-52). A large, flat, crescent-shaped, bifacially flaked limestone slab may have been used for digging or cleaning out hearths and pits. It hardly seems durable or sharp enough for any other function.

At the Crown site eight hammers are present in the McKean component and four of these have dual uses as anvils. Only five hammers are documented in the Hanna component, and two of these may be utilized cores. Quigg (1986: 135) notes that these correlate with lithic debris concentrations and likely reflect use in core reduction.

In addition to the hammers and anvils noted at the Cactus Flower site, a chopper/hammer category in Appendix B, Table 2 is a conglomerate of Brumley's (1975: 54-57, Plates 27-29) heavy chipped stone tool subgroups 1, 2, 3 and 4. Discrete hammerstones are present in the lower three McKean occupations and anvils are present in occupations VI and VIII. The addition of the chopper/hammer category extends this general purpose tool's presence to every occupation layer. Higher numbers are in occupations IV, VI, VII and VIII. There is a small, (about 45 mm by 49 mm) circular, highly polished stone present in occupation VI, which might be identified as a small mano - if found in Wyoming (see Brumley 1975: 61 and Plate 33, letter E). Whether this specimen indicates plant processing, as other manos are often assumed to, is debatable. Some alternate uses include hide processing, bone, antler or wooden tool sharpening, edge rounding in lithic production and small animal processing (Adams 1988; Morlan 1992b; Schultz 1992). A stone pipe is identified in occupation VIII and Brumley (1975: 97) ponders as to what substance would have been smoked in it. Although this may be a smoking pipe, another possible use for this item may be as a shaman's sucking tube (see Bonner 1985; Steward 1937; in Frison and Van Norman 1993).

Bone and Antler Tools

Only a few possible bone tools with polish are identified from the Redtail site from layers 11, 12 and 13(2). Functions of these are indeterminate. No antler is present. At the Crown site three polished or blunted bone tools are identified in each of the McKean and Hanna components. Antler is represented by a tine tip fragment in the McKean component, and a cut base/core of an elk antler is in the Hanna component. The Cactus Flower site contains 12 awls, 12 polished and blunted tools, 3 bone beads and 9 other worked bone pieces (see Appendix B, Table 2). Three antler tip or tine fragments are also present. These items are distributed from occupation IV to occupation IX, with the greater numbers in occupations IV, VI and VIII. The greater number of identified bone tools at the Cactus Flower site as compared to the Crown or Redtail sites may reflect cultural factors, or more rapid deposition processes and somewhat better bone preservation.

Faunal Aspects

The various faunal MNI are presented for the Redtail site's layers in Appendix B, Table 4. Bison are present in all occupations. The low MNI numbers quite likely underrepresent the actual number of individual animals because the bone has been severely fragmented by both cultural and natural processes (similar to Marshall and Pilgrim 1993). Immature bison are present in 7 of the 11 layers presented in this table. Deer and pronghorn specimens are only present in layers without McKean diagnostics. Canid remains, of varying sizes, are present primarily in layers, 10, 11, 12, 13(1), 13(2) and 13(3) associated with the McKean tradition. Layer 13(4) is the exception. Rabbit remains are present in layers 12 and 13(2), and Mustelid in layers 11 and 13(2). The only bird remains in layers with McKean diagnostics are a robin in layer 13(1) and a crow and mallard in layer 13(4).

Some tenuous seasonalities are suggested for six of these layers. Three spring/summer occupations are indicated in layers 8, 11 and 13(4). A summer occupation is suggested for layer 13(1) and a spring occupation for one of the three layer 14 occupations. Two fall/winter occupations are possible for one of the layer 8 occupations and for at least one occupation in layer 12.

The Crown site fauna is presented in Appendix B, Table 3. Bison, rabbit and fish are present throughout. Both McKean and Hanna components also contain elk, moose, canid, beaver, bird and mollusk. Differences include a black bear in the Hanna component, and a skunk and a dentalium shell in the McKean component. Seasonality for the McKean component is mid-winter/early spring. The Hanna component is late spring/early summer for at least two of its occupations. An occupation between the McKean and Hanna components, termed "sterile", is determined to have a late winter/early spring seasonality.

Cactus Flower site fauna contains bison throughout its McKean occupations. Pronghorn are present in four occupations and canids in five. Rabbits and birds are each present in three occupations. A single mule deer is represented in occupation VI. The few fish and mollusk remains are thought to have been deposited by non-human predators. Most faunal variety and MNI appear to be present in occupations IV, VI, VIII and IX. Seasonalities for four occupations are determined. Three of the occupations (IV, VIII and IX) seem to be fall/winter. A more general spring/summer/fall season is suggested for occupation VII.

Features and Patterns

At the Redtail site surface hearths are the dominant feature and are present in every layer where features are preserved (e.g. layers 8, 10, 11, 12, 13). Basin-shaped hearths are noted in layers 8, 11 and 13(2). A basin-shaped pit in layer 12 is associated with a high amount of FBR both inside and about its perimeter. This was likely used first as a hearth and then as a midden. It does not resemble a rock-lined hearth in this state but does have considerable amounts of FBR and other rocks scattered around it. Three other pits were noted. One in 13(1) may have been a cache pit and/or a processing pit. In layer 8 a half circle (probably about 3.7 m diameter) is a depressed area which contained a large cluster of hearth and pit features and is identified as a shallow pithouse or depressed habitation structure. An interesting feature in layer 10 is a nearly complete bison skull with a smashed base and two pairs of nasal bones. In each of layers 11 and 12 a circular to oval (about 3 m diameter) debris concentration is associated with feature clusters. These are thought to delineate the outlines of temporary living structures at the site, similar to that identified by Brumley (1975) at the Cactus Flower site.

Few features are present at the Crown site. This may be partly a reflection of the excavation methodology and complex strata. Three surface hearths and a bone pile are present in the McKean component. In the Hanna component a FBR pile, a FBR filled pit/hearth and a child burial are identified. A large pit/hearth (150 cm by 100 cm by 20 cm) in the upper occupation of the Hanna component was full of FBR, burned bone fragments and lithic debitage. It also contained a "broken Hanna projectile point and a well-made biface", in addition to numerous other stone tools found in the vicinity (Quigg 1986: 113). In the middle Hanna occupation a pile of FBR is present (Quigg 1986: 113). The buried child was in the lowest Hanna component occupation. It was between two and four years of age at death, and had been laid supine in a shallow pit (see Quigg 1986: 114-115; Walker 1986: 247-261).

At Cactus Flower 15 surface hearths are present throughout six of the eight occupations (see Appendix B, Table 2). Sixteen basin hearths also are present in six of eight occupations. A single rock-lined pit is noted in occupation

X, six oval to circular pits are spread between occupations III, VII and VIII. It may be noted that four of these pits are in occupation III, in addition to three other irregular pits and six hearths. The general scarcity of stone tools and fauna in this occupation, and the presence of four awls and another bone tool suggest that people were puncturing hides. These items and features suggest the use of these pits for hide smoking (Binford 1967). Such pits should contain primarily charcoal, ash and little or no fire reddening stains. These attributes are present for feature numbers 23, 28, 30, 33, 38, 39 and 40. Some of the hearths also exhibit the same characteristics except that fire-reddened earth is often present, (e.g. feature #'s 7, 24, 29 and 35). Alternatively, people may have been processing plant or animal materials. This, however, should be reflected by greater amounts of animal remains or perhaps rock-lined pits, unless people were drying strips of meat. Feature #34 is the only pit containing "a number of flakes and butchered bone fragments" (Brumley 1975: 23). A couple of the hearths produced greater amounts of bone materials (e.g. feature #'s 32 and 37). The majority of features and types of tools present support the hypothesis that hide and meat smoking or drying was a dominant activity in occupation III.

Two possible structures may be outlined at the Cactus Flower site. These include, in "Occupation VI, a well defined arc of stone clearly representing a stone circle with a hearth in the center . . ." and in "Occupation VIII, a clearly defined circular concentration of cultural debris [that] appears to reflect the outer margins of a lodge" (Brumley and Dau 1988: 31-32).

General Material Aspects

This section includes general characteristics such as the presence or absence of materials such as worked shell, ochre/paint, distinct or different lithic materials or other noted aspects. In addition, general occupation activities may be reflected by average weights per unit area of FBR, debitage, bone and burned bone. These may be compared to the total excavated area sampled for each occupation (see Appendix B, Tables 2, 3 and 4).

Chipped lithic raw materials at the Redtail, Crown, and Cactus Flower sites are dominated by local varieties in all occupations. Some lithic materials represent more distant trade connections and/or movement of at least some group members. At the Redtail site there are a few small rejuvenation flakes of Tongue River silicified sediment. The presence of this material suggests a southern (Montana) connection for at least one of the layer 12 occupations. The Cactus Flower site contains some obsidian specimens. This includes a point, listed as Duncan (Brumley 1975: 39), but the only point with obsidian luster observed in the photographs is designated as a Hanna point specimen #2419-1 (see Brumley 1975: Plate 15, letter T). It cannot be determined from the report with which occupation this point is associated. However, nine obsidian hydration dates were obtained on material from Occupation VIII. It is possible that all these obsidian materials are from this Occupation VIII and indicates movement and/or trade to the south. A dentalium shell fragment is identified in with the upper McKean occupation and reflects long-distance trade networks to the Pacific coast (Quigg 1986: 87-89).

The Redtail site contains hematite and limonite cortex and soft fragments. As well, some features had red splotchy stains that are possibly from red ochre paint. The lumps and fragments are recorded as total grams per occupation in Appendix B, Table 4. It may be noted that many pale yellow siltstone/limestone slabs and their fragments are common in occupations 10 through 14. Most of these are considered natural, but were mapped to discern possible patterns. No such other materials are noted for the Crown site. Brumley (1975: 61-62) also suggests that broken pieces of a red burned fused shale may have been used to make red ochre-like paints. At Cactus Flower a shell bead and shell disk are noted. A dentalium shell fragment is identified with the upper McKean occupation at the Crown site (Quigg 1986: 87-89).

Some general standard measurements of cultural materials can be used to compare occupation layers within and between sites. Comparisons of FBR between Redtail, Cactus Flower and the Crown site occupations are presented in Figure 8.2. At the Redtail site FBR weights per m^2 are low for layers 8, 9, 13(3) and 13(4). Moderate amounts are indicated for layers 11, 13(1) and 13(2), with very high relative amounts indicated for layer 12. The FBR at the Crown site indicates low relative amounts for the McKean component and very high amounts (nearly equivalent to Redtail's layer 12) for the Hanna component. Cactus Flower has relatively low average weights of FBR/ rock (undifferentiated) in occupations III and V, moderate amounts in occupations IV, VI, VII, IX and X, and moderately high average weights in occupation VIII. The higher average weight in Cactus Flower's occupation VIII and Redtail's layer 12 correlate with proposed fall/ winter seasonalities and suggest use of FBR for heat retention at winter camps. However, the Crown site has a late spring/ early summer seasonality associated with the high FBR unit weight in the Hanna occupation. Perhaps this seasonality should be extended to include late winter and/ or early spring in at least a few of the three to four occupations lumped in this component. Alternatively, stone boiling and cooking may have been a predominant activity in late spring/ early summer.

Debitage comparisons between these three sites reveals some interesting differences (Figure 8.3). Both of the Crown site's components contain very high relative unit weights of debitage. Only two of the two Cactus Flower site's occupations, VI and VIII, are comparable. This pattern likely reflects the import of large river cobbles for cores and their associated lithic reduction debris. Some moderate reflection of this pattern is also indicated in Cactus Flower's

Figure 8.2 Cactus Flower, Crown and Redtail FBR/m2 per Occupation

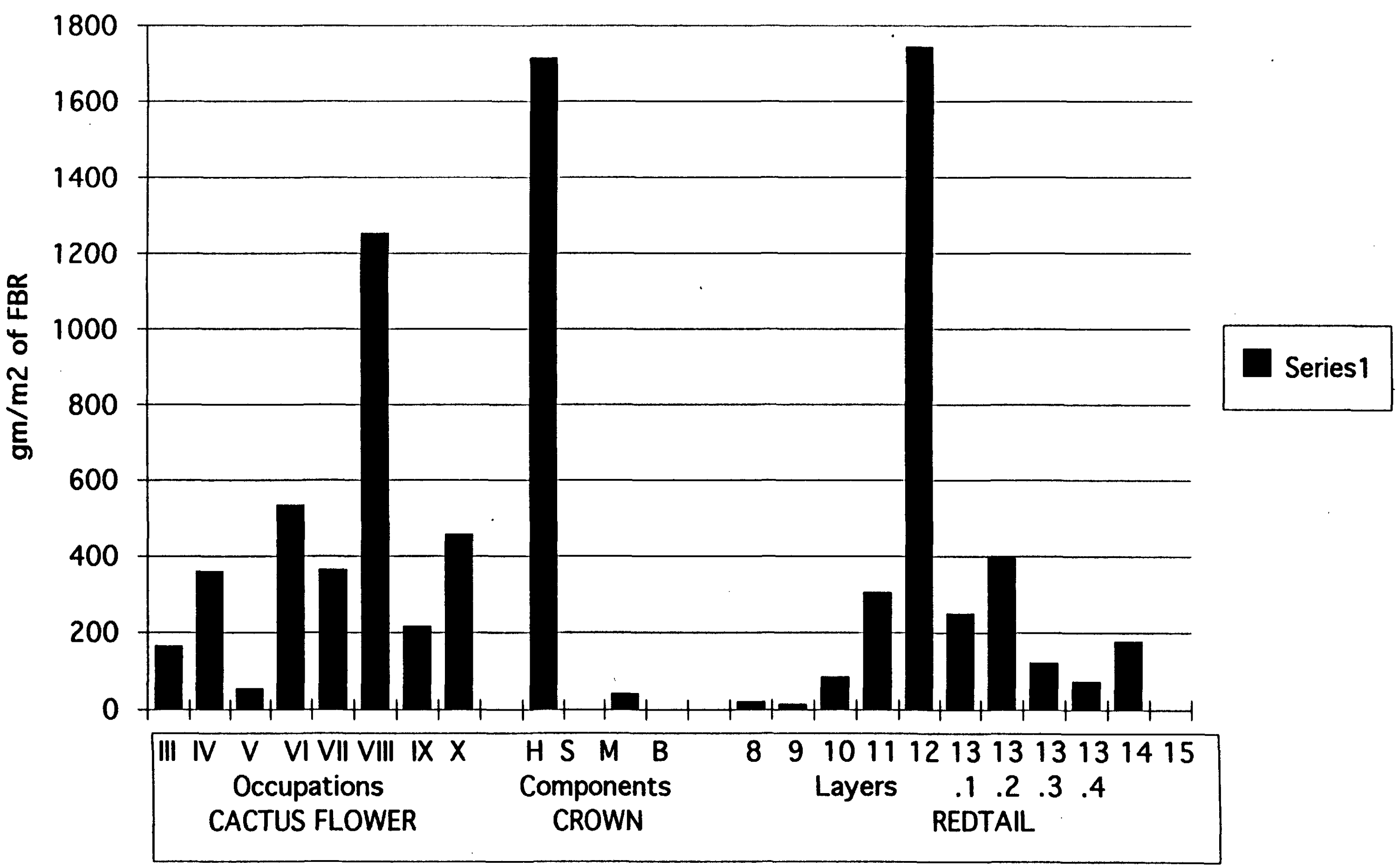
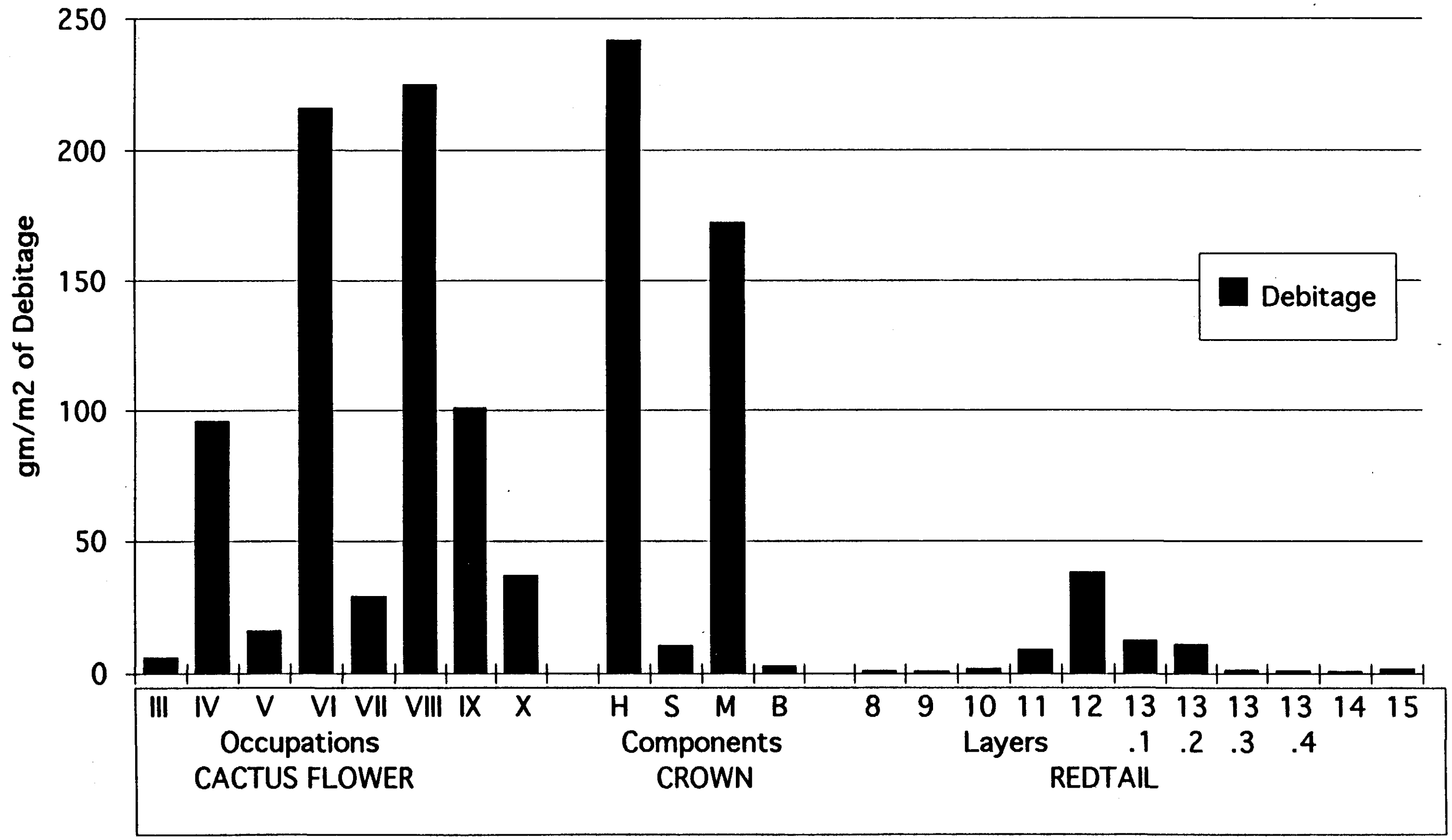


Figure 8.3 Cactus Flower, Crown and Redtail Site's Debitage/m2 per Occupation



occupations IV, VII, IX and X. At Redtail, layer 12 indicates a low moderate unit weight, again suggesting some of this activity. The other of the Redtail site's occupations and Cactus Flower's remaining two occupations indicate very low unit weights for debitage. This suggests that tools, cores and preforms were prepared elsewhere and that these items were resharpened on site. These layers represent either shorter occupations, or the possibility that lithic production was a subsidiary activity, at least in the area(s) of the site excavated.

Average unit weights of bone and burned bone may help indicate other possible activities (see Figure 8.4). High values are present for the Redtail layers 11, 12 and 13(2), while moderate values occur in layers 8, 9, 13(1), 14 and 15. Layers 9, 13(3) and 13(4) have lower values, although the latter is in the upper end of this range. Burned bone is moderately present in layers 11, 12 and 13(1), and high in only layer 13(2). The Crown site has a moderate amount of bone in the McKean component and a very high amount (45%) of it is burned. The Hanna component has a very high amount of bone of which a relatively high 20% is burned. The average unit weight of bone in the "sterile" occupation at the Crown site is low and it is 80% burned.

At Cactus Flower burned bone is not presented in the data. However, overall bone unit average weights are high in occupation VIII and moderate in occupation VI. All other occupations are in the low value range, with occupations VII and IX slightly higher than the other values.

8.3.2) Other Saskatchewan McKean Components and Collections

There are no other sites presently known with multiple stratified McKean occupations in the study area. A few sites contain individual McKean components within a broader stratified material culture context. One of these is the Sjovold site (EiNs-4), which is located "on the west bank of the South Saskatchewan River about 5.5 km SSW of Outlook. The site is at the junction of

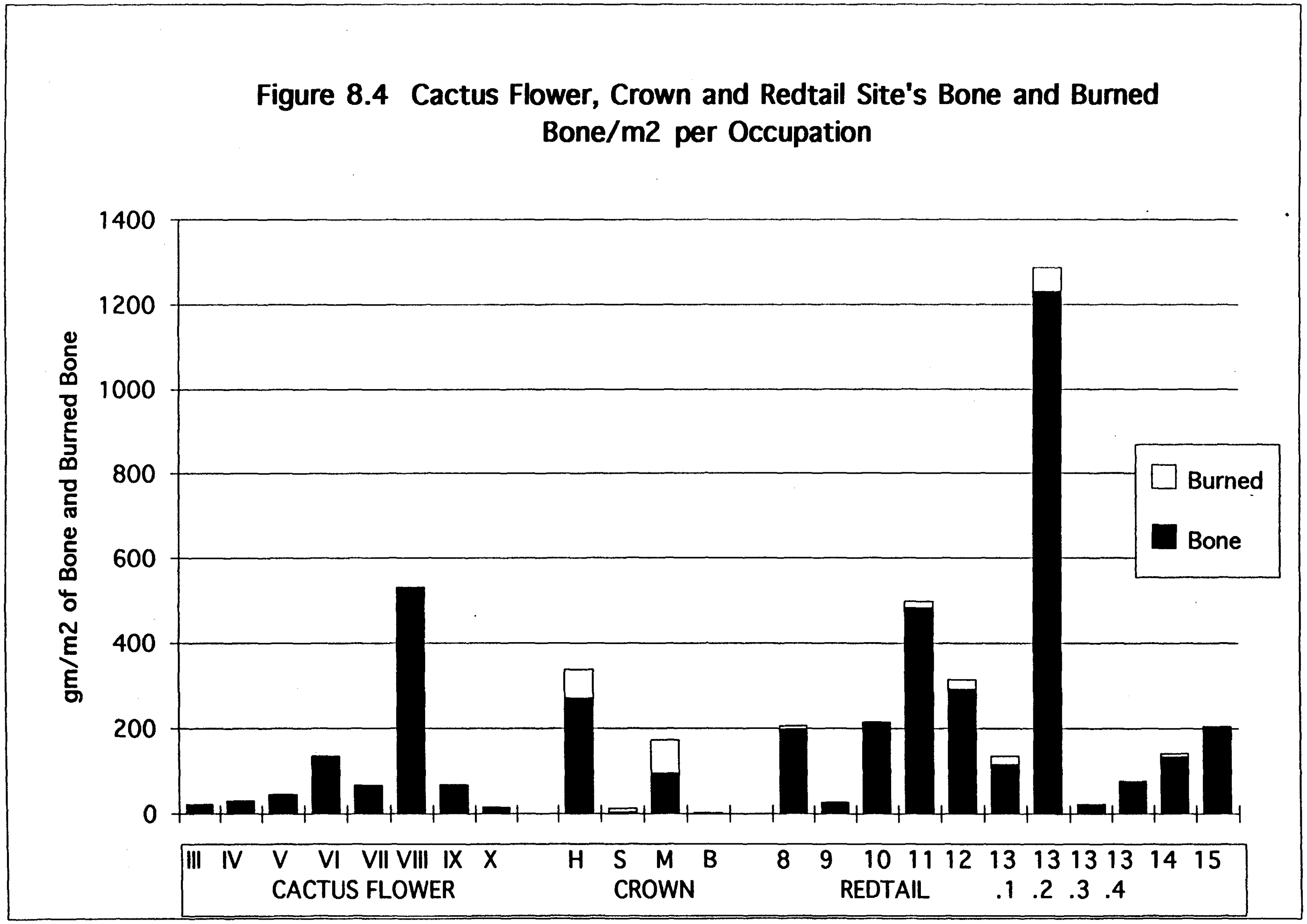


Figure 8.4 Cactus Flower, Crown and Redtail Site's Bone and Burned Bone/m2 per Occupation
1400
1200
1000
800
600
400
200
0
gm/m2 of Bone and Burned Bone
Burned
Bone
III IV V VI VII VIII IX X
CACTUS FLOWER
H S M B
CROWN
8 9 10 11 12 13 13 13 13 14 15
REDTAIL .1 .2 .3 .4

the river with a small creek and rests within a ridge-like deposit of fluvial, colluvial and eolian sands and silts" (Ian Dyck, personal communication 1990, November 6).

Though materials are in the process of analysis Dr. Ian Dyck graciously provided me with some preliminary information for comparative purposes. A single Hanna point base fragment, which closely resembles the one depicted in Dyck (1983: Figure 10.21a; from Ian Dyck, personal communication 1990, December 13), was recovered adjacent to a surface hearth in occupation layer 21 (Ian Dyck, personal communication 1990, November 6). Pelican Lake occupations are above this. A charcoal concentration is the only other feature in this occupation. It is exposed in a 2 m by 6 m area to a depth of 4.2 m below the surface (Ian Dyck, personal communication 1990, November 6). The 172 FBR from this layer weigh 11, 616 gm. This averages to 968 gm/ m^2, and is comparable to the highest concentration category of FBR noted in the Crown, Cactus Flower, and Redtail site occupations. This may suggest winter habitation (using rocks for heat retention), stone cooking, or other processing functions. Faunal remains include NISPs of 1 deer or pronghorn, 53 Bison and 731 unidentified large mammals, in addition to two vole MNI (information courtesy of Dr. Richard E. Morlan, Ian Dyck, personal communication 1990, November 6). Two dates are obtained from this occupation. One from a bone sample in a nearby test had counting problems, but was recalculated (adding 700 rcy) to provide a date of 4130 $\pm$205 rcy B.P. (S-91770). Another date from a broken bison femur in the same level and exposure as the Hanna point resulted in a date of 3530 $\pm$115 rcy B.P. (S-2062) (Ian Dyck, personal communication 1990, November 6 and December 13). The first date is problematic and perhaps should be discarded, because even at two standard deviations the latter date, from a better context and association, barely overlaps. This is supported by Morlan's (1993: 22) radiocarbon date.assessments.

Two other well-stratified sites with McKean components are not associated with the main Saskatchewan River valley. These include the Mortlach (Wettlaufer 1955) and the Long Creek sites (Wettlaufer and Mayer-Oakes 1960). The Mortlach site (EcNn-1) is associated Aiktow creek. Prior to the flooding of Lake Diefenbaker, this creek flowed back from the South Saskatchewan River into the Qu'Appelle River system during high spring floods. The Mortlach site is located on the south side of Sandy Creek, a tributary of the general Qu'Appelle system. It is in a marginal ecotone between the sandhills and Regina Plains locale. At least three Duncan projectile points were recovered from zone 8, the lowest occupation at this site. Pelican Lake occupations are above this. Two ovate biface preforms or general bifaces are present (see Wettlaufer 1955: Plate 14, #'s 8 and 9). A large ovoid biface is present in addition to a squared biface, two large pebble scrapers, one domed and three flat end scrapers, and three to four utilized cores or choppers (see Wettlaufer 1955: 58-60, Plate 13 and 14). Lithic materials from this occupation are predominantly chert and quartzite and total 63 in number (Wettlaufer 1955: 80). Faunal remains are not presented in this report and have subsequently been lost (Ian Brace personal communication, 1990). Although ash concentrations are noted in other occupations at the site, none are noted in this layer. This occupation is in a sandy soil and organics were not preserved or were removed by fluvial processes (see Wettlaufer 1955: 82). A single radiocarbon date from this occupation from a bone sample is 3400 $\pm$200 rcy B.P. (S-2) appears to fit into the range of McKean dates. However, Wettlaufer (1955: 71) considered this date to represent a minimum age. Morlan (1993: 39) considers this a poor date because of the less refined methods of sample pre-treatment and the early counter equipment used.

The Long Creek site (DgMr-1) is in the southeastern corner of Saskatchewan along.the southern edge of Long Creek, a tributary of the Souris River complex, and is adjacent to a spring. It is at the base of the creek's main valley slope. This is generally a Mixed-grass Prairie ecodistrict. In level 5 only a single Hanna point is present in addition to one plano-convex endscraper, two flat endscrapers, one blade-like unifacial graver, an ovoid uniface, and a tipped corner uniface. Faunal remains include bison (some articulation was noted), canid, rabbit, pocket gopher remains, and a human premolar. A bison rib bone was possibly used as a scraper and a coyote canine is modified with a series of 31 indented dots. Wettlaufer and Mayer-Oakes (1960: 48) did not notice any pattern and proposed that this was a gaming piece. Although diagnostic points are few, a stratified relative sequence here indicates a Pelican Lake component immediately above (level 4), an Oxbow component below (level 7), a possibly mixed Oxbow/Mummy Cave assemblage (level 8), and a Mummy Cave or early side-notched assemblage below this (level 9). Level 6 did not have diagnostic points but produced a point tip, three ovate/rectangular bifaces, two hafted and three unhafted flat endscrapers, a flake scraper, an oil-soaked grinding stone, and a large scraper/chopper tool. This layer is proposed by Wettlaufer (1955: 110) to be comparable to materials from other side-notched components (e.g. at Logan Creek). However, considering the sequences of other stratified McKean sites, this occupation could also be associated with an earlier McKean occupation. A charcoal sample from the upper part of layer 5 produced a date of 3370 $\pm$115 rcy B.P. (S-63a) (Dyck 1983: 90, Table 10.2) and is considered acceptable by Morlan (1993: 38-39).

There are a number of other sites with McKean assemblages. These are either incompletely analyzed or reported, or are small excavations or surface collections. Of these sites the only substantial excavation was at the Broken Axle

(FhNc-81) site. Smaller test excavations were carried out at the Billett (EkNv-36), Graham (FaNq-30), and Sullivan (EjNr-1) sites. Additional collections of McKean materials are noted from the Sullivan, Big Kill (EbNj-2), and sites recorded during the Nipawin Reservoir Heritage study along the Saskatchewan River. These latter sites are useful because they provide consistent locational and association data, and are part of the Saskatchewan River system. They are also closely associated with the Crown site.

Several mixed component sites are present throughout Saskatchewan. This is particularly evident from sites found in the Nipawin Reservoir Heritage study area in conjunction with the Francois-Finlay hydroelectric project. Some of the sites from the 1982/1983 study with more definite McKean materials are briefly discussed. Some indefinite "Hanna" points are not included in this survey summary. For further information see Finnigan *et al.* (1983).

The Mollberg site (FhNa-1) is part of a large (greater than 1 km long) site on the valley summit and is partly cultivated. Initial assessments produced four Early Side-notched points, two Oxbow points, four McKean Lanceolate points, a Duncan point, two Hanna points, five Pelican Lake points and a large side-notched pointed biface (see Finnigan *et al.* 1983: 89, 94). The Berry Picker site (FhNc-8) is located on an upper terrace and contained two McKean Lanceolate points and a large pointed side-notched biface (see Finnigan *et al.* 1983: 89 and Figure 3.6, letters i, j and k). Two isolated McKean Lanceolate points are recorded on the lower terrace at FhNc-46 and FhNc-54 (see Finnigan *et al.* 1983: 90, 99). The Orviak site (FhNa-73) includes materials recovered from a cultivated field on the upper terrace. These include a McKean Lanceolate, a side-notched and three triangular points (see Finnigan *et al.* 1983: 126, 128). The Windrow site (FhNa-93) is on a cultivated upper terrace and contains three Paleo-Indian point fragments, a Hanna point and another corner-notched point (see Finnigan *et al.*

1983: 127-130). The Canteen site (FhNa-95) is also on a cultivated upper terrace and includes an early side-notched, a triangular, an Oxbow and a McKean Lanceolate point (see Finnigan *et al.* 1983: 127, 130). At FhNa-46 two McKean Lanceolate points, extensively reworked, are associated in the general site area with late side-notched points and potsherds. At the Morrissey site (FhNb-57) there are two to three Early Side-notched points and a Duncan point present in a cultivated field at the valley summit (see Finnigan *et al.* 1983: 133, 136). An isolated McKean Lanceolate point is noted at the Elk Traps site (FhNb-4) located on the lower terrace (see Finnigan *et al.* 1983: 136-137). Isolated finds appear to predominate on the lower terrace and camp sites predominate, commonly mixed with other Middle Precontact period points, on the upper terrace.

Of these sites, the Berry Picker site, though cultivated, appears to be a discrete McKean Lanceolate-associated occupation (Finnigan *et al.* 1983: 225-226). Besides the two points and hafted biface, other materials from this site include two point preforms, eight bifaces, seven endscrapers, 10 unifaces, two perforators, two retouched flakes, and two hammerstones. Also, 646 pieces of debitage were recovered, including 28 cores and core fragments. A distribution map is suggestive of two or three main concentrations and a few outlying scattered materials (see Finnigan *et al.* 1983: 226). Five endscrapers are present in a linear cluster parallel to the river and adjacent to an oval material cluster which contains one of the points. The linear cluster and another peripheral concentration to the east suggest primary activities of biface production, general core reduction and other processing/ cooking activities. These materials may warrant further study for technological, functional, and spatial patterning aspects.

The Broken Axle site was discovered in the course of the Nipawin study in 1982 during a transect survey. It was located on a lower terrace, Hamilton Flat, on the north bank of the Saskatchewan River. Initial tests and a 2 m by 2 m excavation produced substantial amounts of FBR, debitage, bone fragments, four utilized flakes, and a point tip. Based on varying artifact densities it was suggested that four poorly separated occupations could be distinguished in the 65 cm deep units (Finnigan *et al.* 1983: 275-278). The lowest occupation, from square 3 (level 10, 51-56 cm below the surface), produced a radiocarbon date of 4350 $\pm$135 rcy B.P. (S-2325) from a large Cervid tibia bone (information from Saskatchewan Archaeological Resource Record form).

Further excavations at the Broken Axle site were carried out in 1985 and expanded into an irregular block of 46 m^2 units, including the four units from the initial test. Since no report has been completed, Western Heritage Services kindly loaned the tools and notes to me for some comparisons. There are some stratigraphic problems at this site due to sandy soils and poor occupational separation. A summary of the fieldnote associations may provide some indication of this.

Jim Finnigan (field notes, June 28 to July 31, 1985) noted a Hanna point associated with a FBR pile in level 7 (note that excavation levels are counted in 5 cm arbitrary units from the surface.) In levels 7, 8 and 9 a large amount of FBR, some bifaces, an endscraper and a hammerstone (in a charcoal stain) were also noted. Two other Hanna points were recovered, one from level 7 and another from level 9. A biface in level 8 was associated with large amounts of FBR and a concentration of debitage. A mid-section of a probable Pelican Lake point was recovered from level 3. An egg-sized piece of red ochre was noted in level 7. Dale Walde (field notes, August 22-23, 1985) noted a circular cluster of rocks in level 5 with no red oxidation.

Tools catalogued for the Broken Axle site include three Hanna-like points, one from level 3 and two from level 7. These three points have their tips broken off. Their haft areas are consistently alike and are described as follows. They have broad, rounded corner-notched indentations which produce relatively long expanding stems which meet with a straight base at an acute angle. Shoulders are sharp or well defined. Measurements and photos of these are presented in Appendix B, Table 5 and Figure 1. One complete Pelican Lake point with relatively broad corner-notches and a straight base is catalogued from level 9. Another fragmented point from level 6 is probably also a Pelican Lake point, as indicated by its small triangular shape and tanged shoulders, but the base and neck are missing. Four other point tips are present, one from level 6 indicates a larger-sized specimen. A larger point mid section fragment in level 7 has rounded shoulders incurving to a broken stem. Three other point base fragments are present. Two are Hanna-like and exhibit rounded basal edges with slightly concave bases. The other has expanding edges meeting a straight base at a sharp acute angle. This latter specimen is similar in shape to the three nearly complete Hanna-like points identified but is more refined in its flaking. This may be a reflection of the better quality SRC from which it is made.

It should be noted that I have labeled the three nearly complete points from Broken Axle Hanna-like, but I am uncomfortable in doing so because they appear slightly different and consistently distinct. These may reflect an individual knapper's characteristic pattern or it could be a different subvariety of McKean or other group's point variants (e.g. Boreal (?) Middle period or Pelican Lake). These points have shoulder and haft characteristics which may even be considered similar to early Pelican Lake. Two Pelican Lake projectile points are in the strata from which these points are collected. A few radiocarbon dates from the excavation levels 6 through 8 may narrow the possibilities. Some of the Crown site's Hanna points are similar to these because of their straight bases and sharp acute basal edges. However, the Crown site's Hanna points have shorter stems and more angular notching of the stem. I have seen points similar to those in the Crown site Hanna component, in a collection from the Garden River area northeast of Prince Albert (FiNj-5 and FiNj-6) (Doug Frey, personal communication, 1992). Overall, these sites contain points that are different from typical Hanna type points and further dates and analyses of collections in the area may help indicate whether they are a local variety of McKean, a transition between Hanna and Pelican Lake, or are a different boreal or marginal parklands group.

At Broken Axle two large pointed biface tips and two smaller side-notched flake tools (one very small) are also present. The larger of the small side-notched flake tools is made from a fine quality brown chalcedony, very much like KRF (Knife River flint). Seven medium to thumb-sized end and side-scrapers are represented, in addition to several other retouched flakes. These scrapers all have high convex dorsal surfaces and steep (>80°) working edges. A larger scraper (50.5 gm) is made from a decortication flake of SRC. A small thin flake of brown chalcedony is also retouched into a unifacial scraper on one edge. Two blade-like items unifacially retouched or utilized along one edge may also be noted. One of these is also made from brown chalcedony.

Twenty hammerstones, four combination hammer-anvils, and four anvils are also at the Broken Axle site. Most of these were recovered from levels 6 to 10 inclusive. Two chopper tools were recovered from levels 6 and 7, respectively. One bone awl and another bone with a polished edge are also present. Other interesting items include a large piece of coral or fossilized sponge material from layer 6, several lumps of red ochre from levels 7, 8 and 10, and distinctive burned hazelnut shells from levels 8, 10, and 11. This rounds out a brief summary of the materials available to me, and will have to suffice until the report is finished.

This information provides an example of a Pelican Lake assemblage mixed with a Hanna-like assemblage.

The Billett site is located in a cultivated low dune area near Harris. A slough is about 200 m from the site. Four Hanna and a Pelican Lake point were recovered from tests by Henry Epp and Wayne Pendree in 1978 . Two hearths were noted, indicating that an intact occupation was present. Additionally, two sidescrapers, two endscrapers, a uniface, one core, eight split pebbles, and 173 pieces of debitage are documented from the tests. Debitage raw material types include 132 chert, 41 quartzite, 25 chalcedony, 4 quartz, and one fused shale specimen. Also, within this 300 m by 500 m concentration of material other Oxbow, Hanna, Pelican Lake, Avonlea, and Prairie Side-notched projectile points were present. Little stratigraphic development occurs here and materials are modified by heavy wind erosion. Two radiocarbon dates closely associated with two hearth features produced results of 3465 ±115 rcy B.P. (S-2063), from a charcoal sample, and 3100 ±135 rcy B.P. (S-2054), from bone fragments (Morlan 1993: 23). The first date corresponds with the Hanna-associated dates from the Crown and Redtail sites. However, the other date is somewhat on the recent end of its predicted age but does overlap with the two standard deviations of error. A third date, 1560 ±160 rcy B.P. (S-2053), is based on a charcoal sample taken from within the hearth with which the S-2054 date is associated (Morlan 1993: 66, Table 2). This recent date could relate to the shallow context and influences from the cultivated field location. Some of the surface-collected projectile points from this site (Billett 1) and an adjacent area about 130 m away named Billett 2 (EkNv-35) appear in Dyck (1983: Figure 10.21). These points include one to two Hanna-like side-notched point variants and four with straight bases. Also, one small and heavily rejuvenated McKean Lanceolate point is present.

The Graham site (FaNq-30) is a burial recovered from a cultivated field near Saskatoon. It was associated with surface debris thought to represent a habitation site (Walker 1984: 140). Charred human remains were recovered from a hearth and associated with a cache of 10 ovate biface preforms, an antler billet, an antler base core, a rib bone awl, a large pointed side-notched biface and a single Duncan projectile point (see Walker 1984: 143-144). Walker (1984: 142) concludes that this was a cremation of a bundle burial. The individual is identified as an adult, (probable) male. The association of the material items may reflect the personal items carried with this individual. These items are present at many of the McKean occupations discussed so far. Such grave offerings or bundle associations suggest that the adult male held a different type of status than did the child buried at the Crown site. A radiocarbon analysis of human bone resulted in a date of 3400 $\pm$200 rcy B.P. (S-1574).

The five known McKean burials are suggestive of a typical burial pattern within habitation sites as Walker (1984) proposes. Besides the Crown (Quigg 1986) and Graham sites (Walker 1984), McKean burials are present at the Dead Indian Creek site (Frison and Walker 1984) and the McKean site (Kornfeld and Frison 1988; Mulloy 1954), which has two. Walker (1984) contrasts this possible pattern with known Oxbow burials. The Oxbow burial pattern is based mostly on the Gray site (EcNx-1) cemetery in southwestern Saskatchewan. Dates from this site encompass a large timespan from over 5200 to 3300 rcy B.P. (Millar 1978). Morlan (1993: 17-19) reviews some of the discrepancies in this set of radiocarbon dates. He also presents new dates from the Gray site which support, to some degree, the older age for Oxbow, but also provides some more recent dates which may indicate a later use episode of the site. Of the 95 excavated burial pits at the Gray site, 52 had red ochre stains associated with them (Millar

1978: 226-228). Thus, Walker (1984) proposes that red ochre is a strong indicator of an Oxbow burial, in contrast to the known McKean burials.

There are 16 complete or nearly complete projectile points recovered from the Gray site, 10 of these from within burial pit contexts. These points include two large pointed side-notched bifaces and two basally indented leaf-shaped points (Millar 1978: 259-277). Three of these "points" are directly from dated contexts. An Oxbow type point, (specimen B46.62), was associated with burial unit 46 which produced a radiocarbon date of 5100 rcy B.P. (S-647). Another Oxbow type point, (specimen 23.800), and a large side-notched, concave-based biface (two fragmented fitted specimens B23.546/558) was from burial unit 23 and is directly associated with a radiocarbon date of 4955 rcy B.P. (S-619) (Millar 1978: 259-267 and 386-389). It may be noted that about five of the other projectile points recovered in excavations are "typical" Oxbow type, while others are less distinctly side-notched and one is somewhat corner-notched in appearance (see Millar 1978: Figure 118). The two basally notched leaf-shaped points (Millar 1978: Figure 119) are compared to similar pointed preforms recognized at several other Oxbow components. Millar (1978: 275-278) notes that these leaf-shaped preforms have been found with Oxbow points at Castor Creek (Wormington and Forbis 1965: 13), Calling Lake (GhPh-102) (Gruhn 1969), Connell Creek (Meyer and Dyck 1968), Coulee Creek (Wormington and Forbis 1965: 142-143), Long Creek's level 8 (Wettlaufer and Mayer-Oakes 1960) and at the Moon Lake site (Dyck 1970). However, unlike many of these other similar specimens, Millar (1978: 271-273) indicates that the basal edges are completed on the two specimens from the Gray site. This suggests that they are finished/functional projectile points. Besides point variation, the population profile was based on an analysis of 305 individuals and suggests "the presence of two morphologically-distinct contemporary groups in the site [and] is taken as a result of marital-exchange.

The interbreeding of dispersed bands on an irregular basis in a loose connubium would be an obvious mechanism" (Millar 1978: 221). Further population studies of this site have indicated that variation is more likely a reflection of age groupings than genetic differences (Pardoe 1980 in Wade 1981). However, the limited cultural "diagnostic" information and the set of radiocarbon dates may suggest an earlier use by Oxbow and quite possibly a later use by other groups such as McKean. The study of Oxbow and McKean relations elsewhere may yet provide further insight into the patterns at the Gray site.

The Sullivan site (EjNr-1) is located in a sandy, gently rolling mixed-grass prairie terrain near Broderick, about five km east of the South Saskatchewan River (Johnson 1975: 9). Edgar Sullivan discovered this site in 1950 and collected from it for several years, recording some provenience. He donated part of the collection to the Saskatchewan Museum of Natural History (SMNH) in Regina (changed in June, 1993 to the Royal Saskatchewan Museum) and part to the Lutheran Collegiate Bible Institute (LCBI) in Outlook. It was recorded and tested in 1951 by Boyd and Dorothy Wettlaufer. Gil Watson, from the SMNH, carried out further tests at this site in 1964. Eldon Johnson (1975) published a short report on this site including an analysis of the points and large hafted bifaces from the LCBI collection. Some of these items are also presented in Dyck (1983: 103).

This site produced 105 projectile points of which about 50 are over 3/4 complete or have distinct diagnostic parts represented. There are about 54 probable and definite Duncan points and 11 Hanna points. None of these specimens have sharp shoulders. Four points are definitely Oxbow and three others have body forms and flaking suggestive of this point type. One or two Pelican Lake points are also represented. Identification of some points is difficult because they are fragmented and/or reworked. Though most materials are local

SRC, silicified peat/ wood and siltstone, one small basal edge fragment is obsidian. Appendix.B, Figure 2 and Table 5 provides photographs and measurements for several of the points from the SMNH collection. The LCBI materials are presented in Johnson (1975: 12-15).

This site had contained significant amounts of bone material. Wettlaufer (1951: 14) after visiting and testing the site, reported that a "sub-strata of buffalo bone extends intermittently over the whole of Section 7." Sullivan also encountered a considerable amount of bone in his excavation and he noted some bones that were articulated (Johnson 1975: 11). He also reported and profiled a 20 cm thick occupation horizon that contained considerable amounts of bone, ash, and FBR. A thin, black organic layer is below this but did not contain notable cultural materials (Wettlaufer 1951: 14-16). Gil Watson (field notes, May 27, 28 and 29, 1964) recovered a Duncan-like point from within this upper bone occupation layer in test unit #3. He also noted an articulated right immature bison tibia and a femur, and a large "butchered" bison tibia from another individual in this layer. Watson (field notes, May 29, 1964) also recorded an Oxbow point at 32 cm below the surface in test unit #3 which was "lying in stained dark zone below 1st bone layer." A hearth was recorded in this lower occupation layer within 60 cm of the Oxbow point. The upper bone bed layer appears to be associated with the McKean materials while the second Ahb horizon is associated with another smaller Oxbow occupation. Due to the sandy soil, disturbances and collection provenience these occupations are mixed, but the great number of diagnostic McKean materials suggests that most collected material belongs to this culture.

Nine large, pointed side-notched bifaces are in the Sullivan site collections. Many of these have crushed edges and are broken. Johnson (1975: 10) proposes that such severe use may suggest that they functioned as "tips for heavy thrusting weapons." Seven basal and body fragments and a pointed tip that fits with one basal fragment are depicted in Appendix B, Figure 3. Two of these are presented in Johnson (1975: 12-13) and he also presents an additional two specimens, #44-7 and #44-14, from the LCBI collection. Most of these specimens are made from heat treated silicified peat which is common in the vicinity of the elbow of the South Saskatchewan River (Johnson 1986: 76-77). Their fractured appearance is enhanced by the poor quality of this material.

Thirteen endscrapers and side scrapers, most with flat dorsal surfaces, are in the SMNH collection in addition to other unifacial and bifacially retouched flakes. A rectangular siltstone tool with dorsal retouch exhibits pronounced use-wear striations on the ventral surface (see Appendix B, Figure 4). Another large basalt chopper/ scraper, weighing 331.0 gm, has worn, rounded edges and has striations on two edges (see Appendix B, Figure 5). Two other large scraper tools made from quartzite cobbles are also present. Three to four tools indicate use of tips or corners as borers.

The considerable accumulations of bone and the articulation of remains indicate a primary bison kill site. The number of points, their fragmentation (from impacts), and reuse indicate a kill and the initial stages of butchering and processing activities. Other stone tools support this general interpretation.

Another McKean bison kill was likely represented at the Big Kill site (EbNj-2) located just south of Moose Jaw. Wettlaufer (1951: 96) also recorded and visited this site. He noted "acres of broken bone, burned bone, artifacts, chips, firestones, etc." These were located along a sandy ridge which indicated both camp and bison kill areas. Wettlaufer (1951:96) also noted that no pottery had been found at this site. A few materials collected here by Austin Ellis were donated to the SMNH. They include five complete and two lower halves of McKean Lanceolate points in addition to three flat endscrapers and three retouched chipped lithic tools. It should be noted that five of these specimens are made from good quality brown chalcedony, likely KRF, and another is made from a good quality fused shale. The sources for these materials are far to the southeast of the site. This would indicate that at least some of these people were from southeastern areas, or were trading with people from that direction. Photos and measurements of these items are provided in Appendix B, Figure 6 and Table 5.

A site peripheral and to the northeast of the study area's margins may also provide some general comparative information. The Pas Reserve site (FlMh-2) was located on a grass-covered north bank of the Saskatchewan River directly across from the town of The Pas. Tamplin (1977) excavated at this site between 1967 and 1972 distinguishing eight stratigraphic units. Stratigraphic unit number 5 was a "Mostly Archaic" occupation with a Laurel phase occupation immediately above but was mixed to some degree (Tamplin 1977: 144). Tamplin (1977: 145-146) reports the presence of stemmed Duncan points and expanding stemmed Hanna points, as well as end and side-scrapers from this occupation (no photos were available). There were two small charcoal-filled pits that were definitely attributed to this occupation. A charcoal sample from one of these pits produced a radiocarbon date of 3190 $\pm$60 (A-1369). Using two sigma standard deviation this overlaps with the other stratified late McKean dates in Saskatchewan. There is a possibility that these materials may be related to boreal forest groups. Too little is known about the boreal forest cultural chronology to speculate. However, the expansion of grassland and Plains fauna (e.g. bison) along the Saskatchewan, Carrot, and Pasquia River systems during the Mid-Holocene Climatic Maximum provided ample opportunity for the apparently adaptable McKean groups to inhabit this area. Faunal remains in this occupation contain notably higher amounts of canid and bison remains compared to most later occupations. There is also a considerable range of other fauna at the site represented in all occupations. Burbot (*Lota lota*) are present in occupations at The Pas indicating an exploitation of this early spring spawning fish (Tamplin 1977: 171). This may suggest at least an early spring seasonality.

There are other sites in Manitoba that are not discussed here as they are considered too peripheral to the study area and because there are potential boreal forest influences such as at The Pas Reserve site. Some of these sites include Tailrace Bay, Cemetery Point (Mayer-Oakes 1970), Filuk and Larter (Syms 1969). An additional site is the Cherry Point site (DkMe-10) in southwestern Manitoba (Haug 1976). It produced a few McKean point variants, but the mixed occupations make this site less useful for comparisons.

In Alberta, some McKean remains are noted, but I am unaware of any that have good context in a stratified situation. A McKean occupation at the Cranford site (DlPb-2) is recognized "just" below another Late Precontact period occupation (Stuart 1990). This site produced at least six McKean Lanceolate type points (see Stuart 1990: Plate 9) which are thought to be associated with a stone circle habitation. I disagree with Stuart's conclusion (1990: 212 and Plate 10) that Hanna are also present here, as the single "Hanna" specimen #6676 is an indeterminate type.

Brumley and Dau (1988: 32) also note two medicine wheels in southeastern Alberta, the Majorville Cairn (EdPc-1) (Calder 1977) and the British Block site (EdOp-1) (Wormington and Forbis 1965; Finnigan 1982), which have nearby associations indicating that they may have been used by Oxbow and/or McKean groups. A stone circle site near the British Block Medicine Wheel appears to date to McKean times (Brumley and Dau 1988: 32). "The Laidlaw site, DlOu-7 consists of a unique antelope pit trap situated along the wall of the South Saskatchewan River valley" in southeastern Alberta (Brumley and Dau 1988:32).

It contained no diagnostic artifacts but produced a date of 3280 $\pm$110 rcy B.P. which overlaps with other late McKean dates (Brumley 1984; 1986; in Brumley and Dau 1988: 32).

8.4) Great Plains McKean General Chronology

The general definition and background of McKean are discussed in chapter 3. Some important syntheses or discussions of McKean studies include Frison (1978, 1991), Forbis (1985), Keyser (1985), Kornfeld and Todd (1985) and Syms (1969). Syms' (1969) comparative study still stands as the most thorough and in depth McKean study, but it is now outdated. Since Syms' (1969) study other important McKean sites have been excavated (e.g. Cactus Flower, Crown) and some previously excavated sites have been further analyzed (e.g. Dead Indian Creek). Still, many important McKean sites are either in obscure preliminary publications, or are unpublished, or remain unanalyzed. Thus, the large picture for McKean remains obscure. Dating and chronology problems will be discussed in this section.

Husted (1968) and Syms (1969) compared McKean sites chronologically and spatially in trying to assess possible origins or movement of McKean technology and style. I have taken a similar approach in reviewing McKean chronology. I have also made some modifications and additions to this approach. Radiocarbon dates are calibrated so that they represent real time and are expanded to two sigma limits. This larger span should provide a better basis for the comparisons of dates from varying labs, equipment, analysts, methods, sample matrix (e.g. charcoal vs. bone), and other collection factors.

The study area is dealt with in slightly more detail first. Information for the available dates in this area from McKean assemblages is presented in Appendix B, Table 6. This table includes cultural material associations based on McKean tradition point type variants. All these samples are either charcoal or ungulate bone, except for the Graham site, which was dated on human bone (Walker 1984). The Cactus Flower, Crown, and Redtail sites provide the stratified basis for assessing radiocarbon dates. A few dates from these sites are considered weaker because of less consistency within their own stratified context (e.g. see Appendix B, Table 6 Cactus Flower and Crown sites). Other older dates (e.g. from Long Creek and Mortlach), shallow cultivated field single component dates (e.g. from Billett and Graham), and problematic dates (e.g. from Sjovold) are considered to be comparatively less substantiated than these dates from a stratified context.

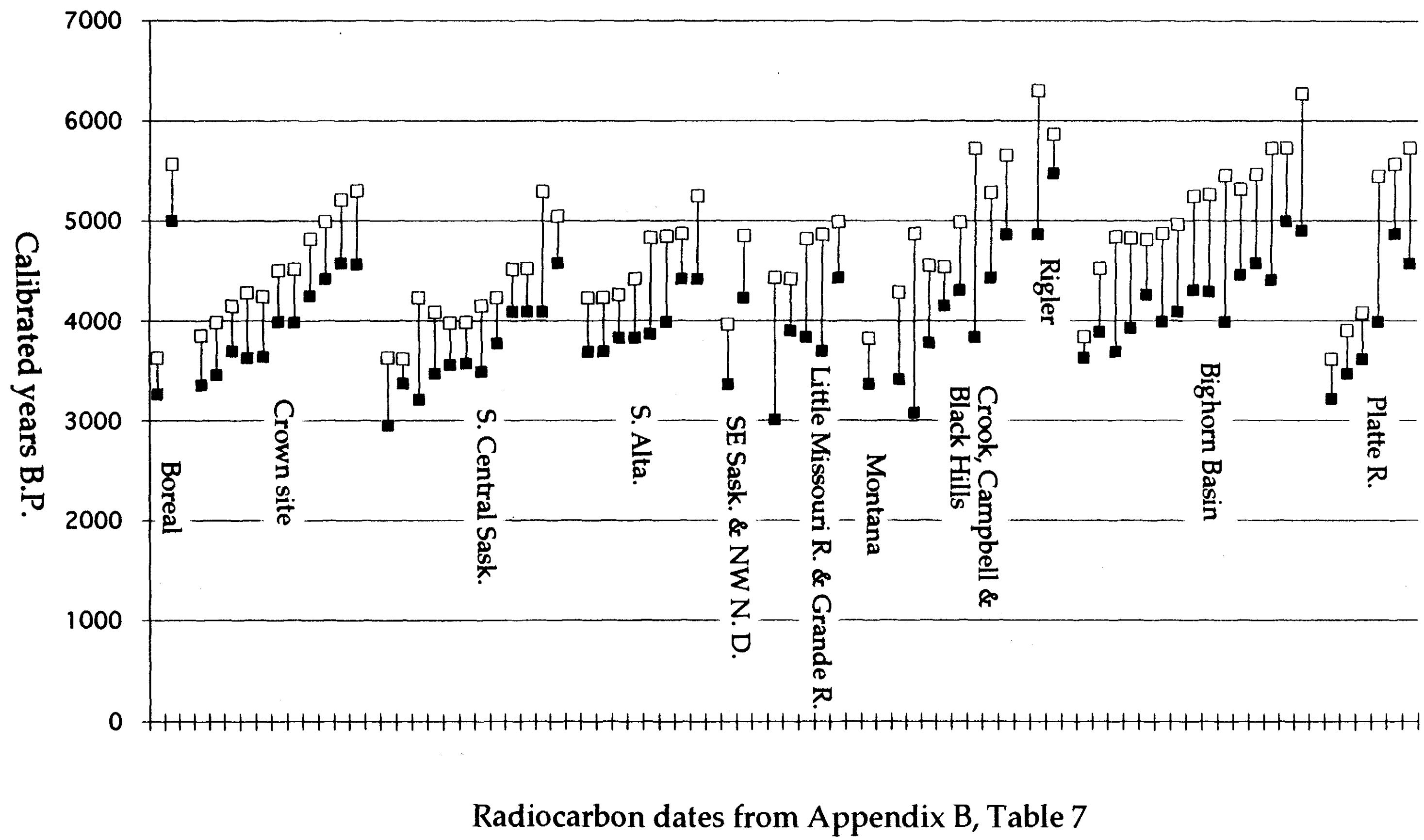
This provides a set of dates to evaluate the potential age of the McKean tradition in this general area. Based on the best ("very good" and "good") dates a span from about 5000 to 3300 calendar years ago (cya) is indicated. It also appears that McKean Lanceolate points are stratigraphically below other types and date earlier in this timespan. The range for McKean Lanceolate-associated occupations is from about 5000 to 3800 cya. This range exempts the single McKean Lanceolate point which dated much more recently in Occupation IV at the Cactus Flower site. This is considered to be either a McKean Lanceolate point picked up and used by the later Hanna group, a rejuvenated Hanna/Duncan point, or a later use of this point type to a lesser degree within the McKean continuum. The Hanna points are dominant within occupations that date between about 3300 to 4200 cya. Duncan point types are associated with components across the whole temporal range of the McKean tradition. Two dated sites with more distinctive Duncan associations are the Graham and Mortlach sites, both of which date quite late, and are comparable to the Hanna timespan. There is a tendency for temporal separation of associated McKean Lanceolate point and Hanna point associated components. Thus, these should be distinguished similar to what Quigg (1986) proposed. For now, information indicates that Duncan point types are common throughout these component associations. Morlan (1993: 38-39) provides a similar synopsis of McKean age spans within Saskatchewan.

This is the situation in the study area's region, but how does it compare with the spatial-temporal framework of the overall Great Plains McKean distribution? Several McKean sites are selected from across the Plains and sorted by regional and local site clusters in Appendix B, Table 7. Sorting is based primarily on physiographic features such as river systems, mountain barriers and environmental zones. Site locations and sources are provided in Figure 8.1 and associated Table 8.1.

Figure 8.5 presents the calibrated two sigma ranges in the sequence of the sites by spatial category given in Appendix B, Table 7. This allows a visual assessment of the McKean age spans for each of these sites and areas. The first area includes only two sites and represents identified "McKean" materials from the present Boreal Forest of the Canadian Prairie Provinces (Figure 8.5). These provide dates from reasonably good context, and may indicate both a later Hanna configuration and an early McKean configuration presence (Appendix B, Table 7). Point photos or measurements, or other cultural material descriptions are not available for these sites. Boreal groups producing similar point types may be misidentified in these cases by analysts most familiar with Plains typologies. However, the ages and identifications seem to fit with the general McKean chronology and some boreal areas were more accessible to Plains groups at this time.

The second set of dates is from the Crown site which represents McKean occupations of the Parkland/Mixed-wood Forest transition ecotone. The later Hanna component identified by Quigg (1986) is different from other

Figure 8.5 McKean Calibrated Ages Across the Plains



manifestations of Hanna. It may be a local Hanna complex reflecting different cultural interactions.

South central Saskatchewan contains five dated McKean tradition sites: Billett, Graham, Redtail, Sjovold, and Mortlach. A southern Alberta grouping includes Cactus Flower and a single other dated McKean component. The review of the study area indicates that age ranges for these groupings do not seem significantly different from each other. The southern Alberta area seems to end about 3700 or 3500 cya but with a larger site sample size this would likely be extended to a range similar to Saskatchewan.

Southeast Saskatchewan/northwestern North Dakota includes the Long Creek and Mondrian Tree sites. These sites may be more affiliated with the McKean tradition manifestations in Manitoba (see Syms 1969). The Little Missouri River provides a route to the Lightning Spring and Red Fox site locales (Figure 8.1). These latter two sites reflect several occupations from about 3000 to 5000 cya. Most of these occupations are likely prior to about 3700 cya. This may suggest an earlier timespan for the dominant Duncan type points at Lightning Spring and Hanna type at Red Fox. A single date from Rosebud Creek County, just west into Montana, suggests a later timespan for a Duncan type associated occupation (Appendix B, Table 7; Figure 8.1 and 8.5). This might reflect older dates from the charcoal samples at Lightning Spring and Red Fox as opposed to the bone sample from 24RB1164. Alternatively, it could support the South Saskatchewan River study area's situation of the Duncan points occurring throughout the McKean tradition timespan.

The Black Hills and adjacent areas incorporate a cluster of sites including Cordero Mine, Gant, George Hey, Hawken II, and Kolterman in addition to the McKean site. These sites generally indicate an age range from about 5600 to 3400 cya, ignoring the Kolterman site's large error ranges. Separation of McKean, Duncan, and Hanna point types has been problematic for this area. Even further excavation at the McKean "type" site has not resolved this problem because it has complicated stratigraphic conditions (Kornfeld and Frison 1988).

About the headwaters of the Yellowstone River a cluster of McKean sites have been identified. One of these sites, Riggler Bluffs, indicates an age range from about 6300 to 4800 cya. Further work and assessment of alpine/mountain groups and charcoal dates from these areas may indicate that this area is more related to a Mountain tradition (e.g. Black 1991). But they may have had considerable interaction and influence on local McKean groups of the same times.

Within the Big Horn Basin and surrounding mountains, 15 dates are presented from 10 sites (Appendix B, Table 7). These are from a range of stratified and single component sites. The age range for this larger sample size is from about 3600 to 5700 cya. The Sorenson site's large standard error could expand this to 6300 but Granite Creek provides a smaller error which extends to 5700. This latter range also overlaps with one of the Dead Indian Creek site's dates. These Big Horn Basin sites tend to have unsorted McKean Lanceolate, Duncan, and Hanna points in addition to other side-notched point types that are mixed in some of these components. This occurrence at the Dead Indian Creek site has led Frison and Walker (1984) to suggest that Mulloy's (1954) assessment of the McKean point type as having a range of variants was correct. Thus, they proceed to abrogate the McKean Lanceolate, Duncan, and Hanna types as proposed by Wheeler (1952, 1954) and simply classify the points as lanceolate, stemmed, and side-notched. This may be somewhat of a backward step and is based entirely on point morphology. The point typologies are not perfect but can be adjusted to include aspects and corrections through recognition of reworking, rejuvenation, and point re-use.

A conglomerate of southern sites are roughly correlated with the Platte River systems. Signal Butte I is considered by Forbis (1985) to be the most southern extension of McKean. At Signal Butte I he recognizes a separation of McKean Lanceolate point types, which dominate in frequency in the earliest occupation IA, and Hanna point types which dominate in the upper occupation IC. A charcoal date indicates an age between 5700 to 4500 cya for the McKean Lanceolate point type-dominated assemblage, and another date indicates a Hanna type-dominated assemblage between 5400 to 4000 cya. The Scoggin site is of an age (5600 to 4900 cya) comparable to the earlier McKean component timespan at Signal Butte I. This site includes McKean Lanceolate points, but are dominated by the Mallory point type (Lobdell 1974). These deep narrow side-notched points are nearly identical to McKean Lanceolate points except they have notches (Lobdell 1974). However, some similarly notched points have been recovered in the Pinto Basin and are identified as San Rafael Side-notched (Reeves 1983b). This site may reflect a communal kill by the two different groups or use of the same kill by groups which overlapped in their territories. This is contrary to Lobdell's (1974) interpretation because he could not distinguish clusters or patterns for the two different point types at the site. However, I doubt that such distinct clustering would occur if a kill were re-used by a different group or used by two groups at the same time.

The Dipper Gap site is a later dated site to the south of Signal Butte I (see Figure 8.1). It may reflect some aspect or influence of Hanna configuration groups in the general area at Signal Butte, but may also have Mountain tradition influence or representation at the site (see Black 1991).

It may be noted that the earliest ages for the McKean tradition tend to be in the Big Horn Basin and adjacent mountain areas as Syms (1969) concluded. Black (1991) has indicated that the Mountain tradition is strongly separated from the Plains groups throughout this area, with separate developments and continuities. I cannot see such a clear-cut case, and the presence of a pithouse structure at Dead Indian Creek, McKean, and other Plains sites of the area may suggest differently. Black (1991) has proposed that this Mountain tradition, preceding McKean in the adjacent Colorado, Wyoming and southern Montana mountains and nearby areas, has likely developed from a Colorado Plateau origin and the marginal areas of the Great Basin. If the later Mountain tradition had some influence on, or split into a Plains-oriented tradition, this may explain some similarities perceived in McKean. McKean, however, seems to have been very well adapted to local conditions across the entire Plains and peripheries. Does this represent the movement of people with a generally adaptation strategy, or does this indicate adoption of similar morphological point types, a biface lithic technology or other material aspects by a number of localized groups? Keyser and Davis (1985) have suggested that a techno-complex diffused to locally adapted groups. It seems from the review of McKean sites in the Saskatchewan River study area, that there are a few exotic materials. These reflect trade connections to the south and possibly the west (e.g. the Big Kill site has KRF, Cactus Flower has obsidian, Redtail has Tongue River silicified sediment and Crown has dentalium). This connection is not strong, but suggests some limited group interaction or movement. This may support the adoption of some techno-complex by localized groups that have interaction and minimal trade between these groups.

Other tool varieties and site features are commonly associated with McKean as well. These include the relatively recent recognition of pithouse structures in addition to stone circles and oval debris outlines. Also, the features present include basin-shaped hearths, rock-lined hearths, inverted cone-shaped, deep pits, as well as other pits and surface hearths. Stone tools generally include notched tools, hafted and unhafted spokeshaves, tipped / graver tools, smoothed stones or flat abraders, grooved abraders, manos and metates, utilized blade-like flakes, flat or bulbous endscrapers, large side-notched pointed bifaces, hafted and pointed unifaces or flake points, hammers, anvils, and choppers (Brumley 1975; Frison 1991; Frison and Walker 1984; Forbis 1985; Forbis *et al.* n.d.; Keyser 1982, 1985, 1986; Keyser and Davis 1985; Kornfeld and Frison 1988; Kornfeld and Todd 1985; Mulloy 1954, 1958; Quigg 1986; Syms 1969, 1970). Stone technologies include bifacial preform sequences, split cobble general reduction, and split pebble cores or wedges. Local lithic materials are predominant. A few bone tools are present (many tipped awl tools) as are antler cores and tine tools. These may represent a majority of the material culture of the Great Plains McKean tradition.

In chapter 3 it is suggested that a more detailed taxonomic system is necessary to aid in distinguishing McKean subgroups. It would be best to start with lower levels of classification but the larger grouping of McKean recognized across the Plains must also be considered. To all intents and purposes, McKean is a wide-spread, long lasting (5700 to 3300 cya) conglomerate of locally adapted populations with similar but variable point types. After some discussion with David Meyer (personal communication, 1993), it may be suggested that such a grouping may best be described as a tradition. In such a sense this use of tradition would not be as all encompassing as Reeves' (1983a) Tunaxa cultural tradition. Syms' (1977) taxonomy may be used to denote subdivisions within the McKean tradition (Figure 8.6). An earlier and later separation of McKean Lanceolate and Hanna point types, respectively, may be used to denote a McKean configuration and a Hanna configuration. Another large regional subdivision of the more plant-food-oriented southern manifestations is based on the presence of manos and metates and stone-lined pits with flotation data, that

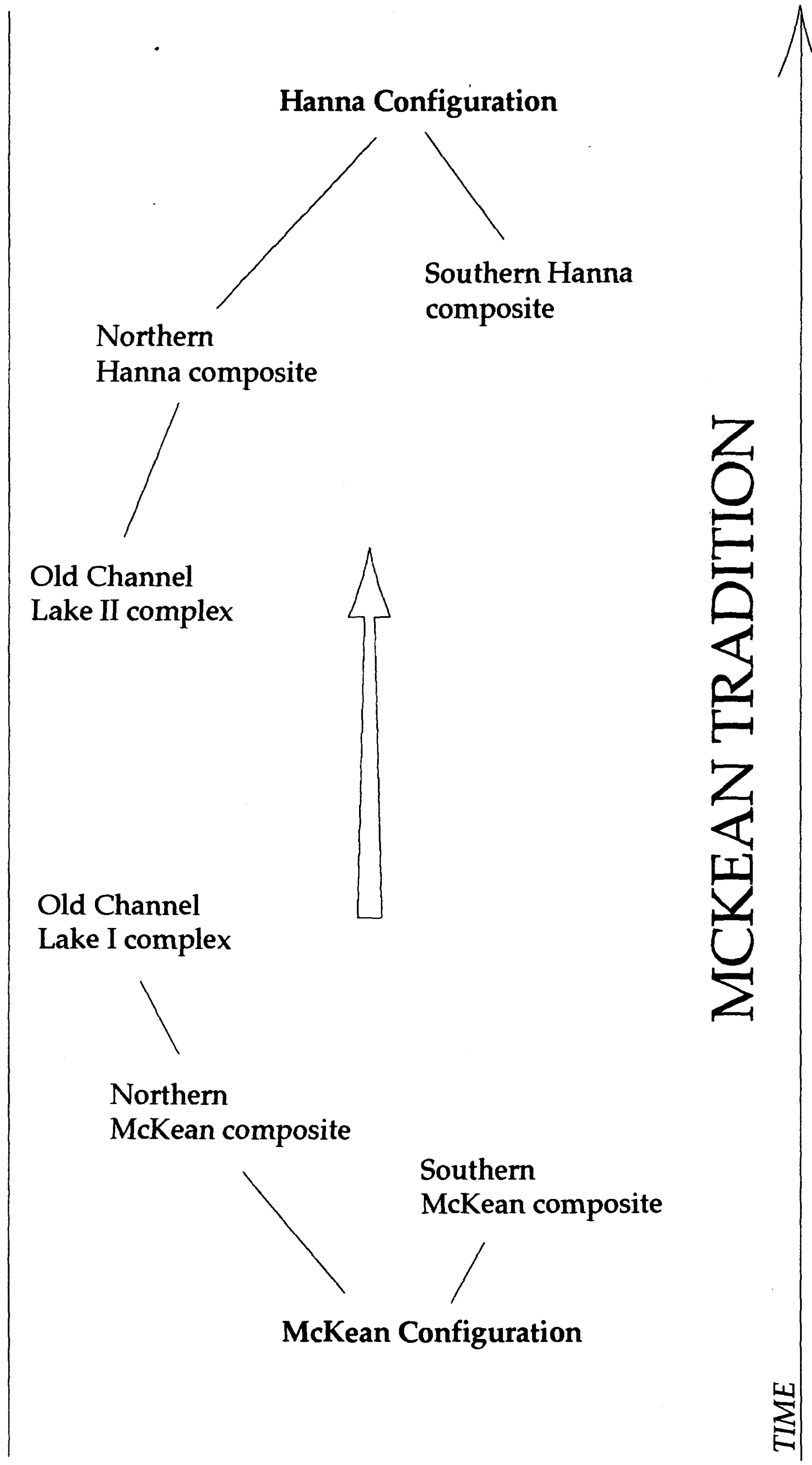


Figure 8.6 A Taxonomic Proposal for McKean

indicate plant processing. The apparent absence of these plant-focused manifestations on the northern Plains may indicate different regional composites within the temporal configurations. Thus, a northern and southern regional composite may be represented within each of the temporal McKean and Hanna configuration. More localized complexes may be identified from clusters of components representing the finer variations within the larger regional composites.

8.5) Discussion

The review of McKean components within the study area along the South Saskatchewan and Saskatchewan River valleys reflects variation within the McKean tradition over time. This is predominantly reflected by the presence of McKean Lanceolate type points in earlier dated and/or stratigraphically deeper McKean occupations and the dominance of Hanna type points in more recent occupations (dated and stratigraphically sequenced). Duncan point types seem to span the range of the McKean tradition but may be more common in the more recently dated occupations. Other cultural materials, such as features, lithic tools/technology, bone tools, subsistence base, and use of FBR do not seem to vary with point type variation. Cultural materials overall seem to indicate similarities of a general adaptation to the local environments. Variations within this material may best be explained by different site locations (e.g. varied fauna at the Crown site), seasonal adaptive variations (e.g. use of FBR for heat retention) or site specific activities (e.g. lithic reduction, bison hide, meat, bone marrow processing, plant processing or general cooking activities).

These same variable aspects and explanations may be reflected at other McKean sites from across the Plains. Thus, an explanation for the perceived variations within McKean across the Plains and locally is attributable to the general adaptations of locally-oriented groups, the members of which are intimately familiar with local resource exploitation. Similarities may be attributable to a borrowing of a general point style form and perhaps a lithic biface technology for making many of these points and other larger side-notched pointed bifaces. The projectile point forms appear to generally change through time across the Plains. Resolution of this variation within McKean seems hindered by poor stratigraphic separation at the McKean type site and other large, significant McKean sites, e.g. Dead Indian Creek and Signal Butte I. These latter two sites may also reflect interaction with the Mountain tradition and northern Great Basin groups, respectively. I believe that adopting a system such as Syms (1977), such variations can be denoted by subdividing the McKean tradition temporally and spatially. Of course, this may create more problems initially, but raising questions is part of the search for answers. This may help sort out the interactive influences between the Mountain tradition, McKean tradition, northern Great Basin's Little Lake groups, and possibly boreal forest groups. These southern regions have more sites for comparisons than the northern Plains. In the northern Plains there are possible influences from the northern Boreal, eastern Woodland, western Mountain, Oxbow configuration (of the Mummy Cave tradition), Pelican Lake tradition, and the southern McKean and Hanna composites that have to be considered.

CHAPTER 9

Summary and Conclusions

9.1) Introduction

The present study is concerned with interpreting and understanding the variation within the McKean tradition. It is mainly based on the analyses of the Redtail site's McKean and Hanna components that span from about 4300 to 3400 rcy B.P. These results are then compared in detail with two other stratified McKean tradition sequences: the Cactus Flower and Crown sites. Some other McKean and Hanna components from the surrounding study area are also reviewed. Some Great Plains McKean tradition comparisons are used to provide a broader spatial and cultural framework for assessing variation through time.

9.2) Interpretations of the Redtail Site

The 1988 and 1989 excavations at the Redtail site contain 15 main cultural layers (at least 23 occupations) in a 44 m^2 block area. This block extends to a depth of 2.3 m and includes over 40 main natural stratigraphic layers. Excavations followed the natural strata. Point provenienced materials are used to backplot to profiles drawn of every 1 m^2 unit's four walls. These allow finer separation of the occupations. Arbitrary levels also separate the thicker strata. This arbitrary separation is correlated with visible separation of layers primarily in the downslope portion of the block excavation.

Natural alterations of cultural materials and some general geomorphic observations indicate that there are considerable post-depositional modifications in most layers. This includes some vertical displacement, likely from rodent or root disturbances. It is hoped that recognition of most disturbed contexts during excavations and point provenience correlations have kept most materials separated. Slopewash processes also have displaced some feature contents downslope and similarly this process may have influenced other small or lighter cultural materials. The spatial analysis approach is based on features with general material patterns overlain at $1m^2$ provenience to minimize such slopewash influences.

Analyses of the Redtail site's cultural layers 8 to 15 indicate that varying activities occurred at this site through time. A few recurrent patterns are also noted between some occupation layers. One example is seen in the charcoal and ash features located down slope from hearth and pit features. This suggests that materials are translocated downslope by slopewash. In layers 12 and 13 another pattern is seen where ash and charcoal deposits are spread radially from a round or oval cluster of cultural materials, including hearth features. This may indicate that materials are culturally translocated in these levels away from the main activity locus.

Some lithic cores, associated with features, may have been used as choppers, wedges, or processing tools at these locations. Most formed lithic tools recovered are frequently in or near features and are broken, reworked, or rejuvenated. This indicates extensive utilization of the few tools present. Unique tools, including a grooved abrader in layer 13 (1) and a large limestone biface in layer 12, are located peripherally to the densest material concentrations. This setting items aside to be found when needed (e.g. curation or caching) may reflect the importance or multipurpose value of these tools.

Each layer represents single or multiple occupations by people who are adapting to a similar environment during different situations. Two to three apparent occupations associated with layer 8 include a possible shallow pithouse structure containing at least seven directly associated hearths, pits, and stains. Less amounts of lithic and bone debris directly associated with this possible pithouse may support its semi-permanent nature . Such a semi-permanent structure is more apt to be kept clearer of debris, with the denser debris accumulations generally located in more peripheral activity loci (Kent 1984; Murray 1980; Schiffer 1987). Such postulates are supported by the presence of peripheral debris and feature clusters. The re-use of such a structure is somewhat supported by an extensively used hammer/anvil stone which later became a FBR, and a range of some tentative spring, summer, and fall seasonalities. TL samples from a large hearth in the pithouse were submitted for dating but the soil was not heated to a high enough temperature or was too porous to provide a valid date. Such an accumulation of ash and charcoal suggest re-use of the feature.

Layer 9 is heavily disturbed by natural processes. This is indicated by an intermittent soil stratum. Overall, materials are sparse. FBR is highly fragmented, perhaps aided by the natural processes which further degenerated the weakened rock. Some preliminary core reduction is indicated, but little else can be interpreted from this occupation.

Layer 10 contains considerable amounts of bison bone, including axial and skull units. Though some adjacent bone units are closely associated (e.g. adjacent quadrants or meter units) with each other, none is observed in articulation. A single composite hearth and bison skull feature is associated with a cluster of pebbles, a notched uniface, and a tipped uniface. A core with reduction flakes is associated with at least two mature bison. This occupation is less habitation-like, having low amounts of lithics, few tools, bison butchering with little processing, and only a couple of features. It may be more closely attributed to a bison ambush or small kill event in the Redtail basin.

Layer 11 has 16 features and a relatively high amount of lithic debris. An oval cluster of hearths, charcoal and ash features, and debris may reflect a temporary structure's outline (about 3 m by 3.5 m). The southern half of this possible structure's living floor contains more lithic debris and FBR. A midden area is 1.5 m to the southeast of this possible structure. This may suggest that the opening for the structure may be in this direction. One body portion of a point in the northern half of the structure is a probable Hanna type. A radiocarbon date from this layer is 3480 $\pm$ 80 rcy B.P. An immature bison in this layer suggests a spring/ summer seasonality. Cut marks on canid remains suggests that they were used as a food source. Flotation analysis of a hearth within the possible structure produced *Chenopodium* and cf. Labiatae, which may have also been used for food (Densmore 1974; Shay 1980). Charcoal in this hearth is identified as cf. *Populus* or *Salix sp.* (Deck 1992).

A basin-shaped hearth located about 2.5 m to the southeast of the potential structure associated with the midden area. A flotation sample from the hearth contains a range of charcoal types, including cf. *Populus,* cf. *Populus / Salix* and hardwood. Several seeds from this feature include *Chenopodium sp. Prunus sp., Rosa sp., Symphoricarpos sp.,* cf. Compositae and several other unidentifiable whole and fragmented seeds (Deck 1992). Many of these have potential food, beverage, or seasoning uses, but three of these also have medicinal uses. *Symphoricarpos sp.* is well represented and has a medicinal value only (Densmore 1974; Shay 1980: Zoltai 1989). Though these are probably culturally used plant remains there are many natural means by which these carbonized remains could be deposited in such a feature. Further flotation analysis of controlled samples could provide a better basis to confirm the cultural use of these remains. There is another nearby activity locus which is dominated by general lithic reduction. These two loci may reflect "outside" cooking, processing, and manufacturing activities likely associated with the possible structure.

Layer 12 represents at least two occupations and has a cluster of seven hearths with associated radially dispersed ash and charcoal concentrations. These are distributed in an oval area about 3.5 m by 4 m in size. A large basin-shaped pit/hearth immediately to the southeast may indicate the general direction of an opening for the habitation structure. It appears that it may have been used in two separate episodes. Within the structure burned bone is highly concentrated throughout, perhaps indicating use as fuel in the hearths. However, highest concentrations are in the midden area to the southeast. There are also considerable amounts of FBR, chipped stone debris, cores, and broken or heavily utilized tools in this midden area.

This midden includes two points likely used as knives, but they still appear very Hanna-like. Another point in this midden appears to be more side-notched, but its shape may be misleading due to the rejuvenation of its body. One side still appears more stem-like. Two hafted and pointed unifaces (flake points) have Hanna-like morphology, except the base on one is convex and the other is a miniature point shape. A large thick, hafted biface base fragment appears Oxbow-like in shape, but seems to have had very broad notches. Nine small re-sharpening flakes of Tongue River silicified sediment are also associated with this general midden area. This may indicate interaction with groups to the south, as this material is associated with southern Montana and South Dakota. A longer or repeated occupation may be indicated by 20 cores of local lithic materials and relatively high amounts of shatter that reflect general core reduction.

Flotation samples were taken from each of the two occupation episodes in the midden area's pit. Both samples included charcoal from cf. *Populus* and hardwood. The lower sample also contained charcoal identified as conifer (Deck 1992). This may indicate the shifting vegetation zones of the Sub-Boreal climatic period or import of this wood from nearby biomes. Seeds in both flotation samples include *Chenopodium sp*. The upper episode also contains cf. Labiatae (Deck 1992). If both of these were used as a food resource as they became ripe, a late summer to early fall seasonality may be indicated (Densmore 1974; Shay 1980). Another flotation sample is taken from a more peripheral activity locus east of this possible structure and midden area. This contains some unidentifiable charcoal and one whole unidentified seed (Deck 1992).

Several faunal remains from layer 12 include at least one adult bison, an approximately seven month old immature bison, three canids (two wolf-sized and one red fox), a jackrabbit, several rodents, a mollusk, gastropods, a toad or frog, and possible fish remains. A tenuous fall/ winter seasonality is indicated by the immature bison, and the plant remains suggest a late summer/ early fall seasonality. This suggests that the site was occupied several times from late summer and possibly into the winter. The amount of FBR suggests use as heat-retaining rocks in the possible structure. As well, the presence of burned bone suggest its use as fuel. Two radiocarbon dates from bone samples include 3470 $\pm$ 80 rcy B.P. from the upper part of this layer and 3660 $\pm$ 75 rcy B.P. from the bottom of this layer.

Layer 13 separates into sublevels primarily in a downslope direction. This thicker layer, which blends together in places upslope, is subdivided into arbitrary levels in order to obtain some idea of distributions across the block area. Thus there may be some mixing for these sublevels, particularly in the upper units of the block area. These are all closely related occupations anyway and could be considered as a larger unit or two units (upper and lower).

Layer 13 (1) contains two mature bison and an immature bison which may suggest a summer seasonality. Some bird remains include a robin which may support a summer seasonality as well. Two main activity loci are indicated by features and material distributions. Burned bone and considerably reduced FBR are associated with both loci. Ten cores and considerable lithic debris reflect general core reduction as a common activity. Smaller-sized flakes and lithic debris suggest final stages of lithic working and re-sharpening of tools. A complete, large pointed and hafted Hanna-shaped biface is in this layer, near another biface fragment. A retouched tool and a grooved abrader are adjacent to a hearth, about two meters away from these bifaces. A grooved abrader used as a general sharpening base for antler or bone flint knapping tools and other items was also found here. A pit feature containing an upright, nearly complete, bison ulna, bone fragments, and FBR may represent a cache pit since a large rock had been placed over it. However, the high amounts of FBR and bone about the feature also suggests that it was used as a boiling pit. The activities at this occupation appear to be bison processing and lithic reduction, including biface manufacture and rejuvenation.

Layer 13(2) has considerable amounts of burned bone associated with five features in the lower half of the block area. Two mature and an immature bison are represented, suggesting potential mixing of the plentiful bison remains in layers 13(1) and 13(2). However, other fauna include two rabbits, a mink, and a *Canis sp*. Layer 13(2) has five cores and debitage fragments located at the east end of the block. Three unifaces within and near a large hearth indicate use on medium to hard materials such as wood or bone. A McKean Lanceolate point and a possible Duncan point basal fragment are represented in this layer. Two radiocarbon dates on bone adjacent to these points and features are 3860 $\pm$ 70 rcy B.P. and 3880 $\pm$ 70 rcy B.P. A smooth-surfaced stone may have been minimally used near this area for food preparation, processing, or honing and rounding implements (see Adams 1988). A flotation analysis of a hearth in this layer revealed a variety of porous and hardwood charcoal. Seeds recovered include *Potentilla sp.*, *Prunus sp.*, cf. *Iva sp.* and other unidentifiable fragments (Deck 1992). These plants are generally used for food and seasoning (Shay 1980; Zoltai 1989). They may also have been stored for use in different seasons.

Layer 13(3) has fewer faunal remains , including at least one mature bison and a coyote-sized canid. The canid tarsal bones are burned, perhaps during cooking. The only tool is a single, large pointed biface tip. This tool fragment is located with a core adjacent to the only hearth identified in this layer. Another focus upslope includes debitage, two cores, bone, and burned bone fragments. There were noticeable amounts of cortex on debitage. Also, some smaller sharpening flakes were present. The cortex may reflect some initial "fresh" core reduction. Also, some biface preform preparation and some finer working or reworking of tools is indicated. These materials indicate a varied but limited occupation. Layer 13(3) may be peripheral to a main habitation area or reflect a shorter habitation (stop-over) at the site.

Layer 13(4) contains three features with relatively sparse faunal, lithic, and FBR remains. The FBR is minimally reduced, suggesting little use and perhaps a short duration of occupation. A chopper/hammer, biface fragment, and two cores are surrounded by bone, burned bone, lithic debitage, and FBR. A nearby smaller hearth is "connected" to this larger hearth by the general debris and has another core and two McKean Lanceolate points adjacent to it. A radiocarbon date on bone from this sublayer, in close association with one of the points, is 4280 $\pm$ 90 rcy B.P. Debitage analysis suggests that bifacial thinning may be a dominant lithic activity. Flotation analysis of the large hearth produced diffuse porous charcoal, and also *Chenopodium sp.*, *Rosa sp.*, a nutshell fragment and 10 other unidentifiable seed fragments (Deck 1992). These seeds are potential food resources available during the summer to late fall (Densmore 1974; Shay 1980; Zoltai 1989). Another small hearth toward the east end of the block has a biface fragment close by. A nearby concentration of bone and burned bone has a hammer central to this debris cluster, suggesting that it was used to reduce bone for marrow extraction. Fauna in layer 13(4) includes at least one mature bison and an immature bison approximately one month old. Bird remains are represented by a Corvidae (crow-sized) and a mallard duck. This evidence, together with the bison and plant materials may support the idea that this area was occupied during the spring/summer season.

Layer 14 has at least three recognized occupations. The more diffuse nature of these sublayers and the sparseness of cultural materials makes separation of the occupations even more tentative. Thus, it is primarily treated as one assemblage, although some analysis provides sublayer provenience if it is available. This layer is modified by leaching of organic remains and may also have had more active water disturbances from slopewash and river flooding. Therefore, no features were observed or recorded in the field. However, two foci of fragmented bone associated with one or two larger cobbles may suggest bone marrow extraction activities. Reduced fragments of FBR are associated with these two clusters and may indicate bone grease rendering as well. Between these two, another locus of activity is represented by a dispersed accumulation of lithic debris, including two cores. Debitage analysis indicates greater amounts of cortex and flakes. This may suggest initial core reduction, perhaps using flakes as tools and/or preparing biface preforms. No diagnostic tools are found in these occupations but activities here reflect short-term limited bison processing and initial lithic reduction activities. The assessments of the human occupation patterns are limited due to natural disturbances.

Layer 15 has at least three occupations represented, but the small area of excavation limits interpretation. No FBR is present. A small amount of debitage but no stone tools are recorded. Bone is present, and lower sublayers contain burned bone. A single bone sample radiocarbon date from layer 15(2) is 5010 $\pm$ 90 rcy B.P. This sample was associated with stone flakes and butchered bison bone.

9.3) Comparisons With Other Sites

A survey of some local sites and collections with McKean materials provides a broader perspective. This may aid in understanding and add to the considerable variations apparent elsewhere on the Great Plains (see Frison 1991; Keyser 1982, 1985, 1986; Kornfeld and Todd 1985).

A comparison of the Cactus Flower, Crown, and Redtail sites, which are connected by the South Saskatchewan and Saskatchewan River systems, provide the contextual and chronological baseline for McKean in this study area. Contextual patterns for this area include a trend, if not a separation, of McKean Lanceolate type projectile points in earlier occupations and Hanna type points in later occupations. This has been a matter of debate for years (see Mulloy 1954; Wheeler 1952, 1954; Syms 1969, 1970; Brumley 1975; Frison 1978, 1991; Kornfeld and Todd 1985). The few diagnostic points in these well-stratified multiple McKean occupations are often disregarded or unrecognized in favor of very productive "point" sites with condensed and often complex stratigraphy (e.g. the McKean, Dead Indian Creek, Signal Butte I sites). More emphasis on context is necessary.

Of course, the interpretation of McKean cannot be limited to a few well-stratified sites. Besides the productive McKean sites, more effort is required to correlate local sites and collections for a better understanding of subregional and local aspects. The modification of Syms' (1977) taxonomic scheme is proposed to organize these materials in order to better delineate regional and local variations within McKean.

It was noticed that more substantial, reoccupied habitation areas, such as the Cactus Flower, Crown, and Redtail sites are in environmental transition zones. The access to different biomes and varied resources of ecotone areas is reflected in the faunal assemblages. This is a common pattern for a centrally based, gathering-hunting society (see Epp 1986; Keyser 1985; Keyser and Davis 1985; Nicholson 1988; Williams 1974). This pattern is apparent in the locations and diversity of fauna at many other Great Plains McKean sites (e.g. Lightning Spring, Dead Indian Creek, and McKean to name a few).

In the study area it is evident that earlier Oxbow and later Pelican Lake groups inhabited the same site areas. Surveys in the Nipawin reservoir suggest that most McKean occupations, with Oxbow, and Pelican Lake materials, are on the upper terraces of the Saskatchewan River. Some sites indicate a stratified sequence of Oxbow to McKean to Pelican Lake (e.g. Brumley 1975; Wettlaufer 1955; Wettlaufer and Mayer-Oakes 1960; Dyck 1983; Dyck *et al.* 1980). The Crown site contains two substantial Middle Precontact period components. The lower one is associated with the McKean Lanceolate type points exclusively. The upper one has been identified as a Hanna component. However, there is more variety of point types represented in this component, which contains at least three to four occupations. An Oxbow and one or two Mummy Cave points from this context indicates that older points were found and re-used by these occupants. Though most points are somewhat Hanna-like and a few may be Duncan-like, this should not be considered as a typical Hanna component. When other points from the Broken Axle site, the Crown site, and a few points collected from FiNj-5 and FiNj-6 are compared, a pattern appears to emerge. These points commonly have straight blade edges, sharp shoulders, stem-like corner notches, sharp acute-angled basal edges, and straight bases. Although this is a limited data set, they have some attributes more similar to the earlier varieties of the Pelican Lake point type. Pendree (1981) and Dyck (1983) have described this earlier variety as having ". . . straight sides, a straight base and corner-notches which usually leave sharp tangs on the shoulders. This type seems to change through time, the earliest forms having the narrowest base, the largest notches and an almost stemmed appearance" (Dyck 1983: 105). However, the points from the Crown and Broken Axle sites, and a few from nearby collections (FiNj-5 and FiNj-6), have these general attributes but are commonly larger, more poorly flaked, and date earlier (at least at the Crown site) than any known Pelican Lake components. Two dates on the early Pelican Lake point associated layers (XIX-XX) at the Sjovold site span 4200 to 3100 rcy B.P. (Morlan 1993: 39). Some similarities may be observed with some Billett site points but these are not from a stratified context. Analysis and interpretation of exceptionally well-stratified occupations in levels 10, 11, 19 and 20 at the Sjovold site should provide some better insights into this possibility (Dyck 1983: 105). For now, these components from the Nipawin Reservoir and the Garden River may be considered a separate complex of the Late McKean configuration.

Other chipped stone tools in McKean occupations include large, side-notched hafted and pointed bifaces. These have often been referred to as "Oxbow knives" but there is enough contextual evidence to associate this tool type with McKean as well. Other tools include spokeshaves or notched tools (some are hafted), various unifaces, flat-topped or secondary/tertiary flake endscrapers, and the ovate/rectangular biface preform sequence outlined by Keyser (1982, 1985).

The Cactus Flower points were used as an example to recognize and evaluate projectile point types. It is suggested that besides morphology (possibly indicating stylistic differences), analysts must recognize the importance of reworking and rejuvenation of points (e.g. Towner and Warburton 1990). This has major implications for the identification of McKean Lanceolate, Duncan, and Hanna point types. Additionally, it seems that the Late McKean peoples may have had more of a tendency to pick up and re-use earlier point varieties, but that they curated and reworked points so that their morphology is quite variable.

This, to some degree, explains the inherent variation that is prevalent, particularly in Late McKean components. This seems less apparent in earlier McKean Lanceolate-related occupations. An added confusion in the study area is the use of leaf-shaped and triangular points, or point blanks by Oxbow. Some of these points are basally indented or concave, similar to McKean Lanceolate points. These have generally been described as thicker, broader, and lacking finer finishing flaking (see the Harder site, Dyck 1970, and the Moon Lake site Dyck 1970; East Pasture site, Millar *et al.* 1972; Gray Burial site, Millar *et al.* 1972; Millar 1978). The general material culture of these groups seems to be very similar, although stronger trade is indicated with Oxbow by the greater prevalence of nonlocal materials such as jasper, copper pieces and dentalium shell (Dyck 1970; Millar *et al.* 1972 and Millar 1978). A few nonlocal materials associated with McKean in the study area include obsidian, Knife River flint, Tongue River silicified sediment and a dentalium shell fragment (Brumley 1975; Quigg 1986). If we assume that increased amounts of trade items are a reflection of increased interaction and diffusion, then the few trade or nonlocal items present in McKean indicate limited interaction. Thus, the diffusion of a McKean techno-complex (Keyser and Fagan 1985) seems to be a weak concept. These McKean and Oxbow groups consistently use the same site locations. This commonality may simply reflect the use of the same general adaptive strategy. The inter-relationship between earlier McKean and Oxbow is an object of further study and investigation.

General chronological trends of McKean across the Plains indicate earliest dates are from the Big Horn Basin area. This may reflect either an area of origin of early McKean groups or a techno-complex diffusion center. The Big Horn Basin seems to have environmental and cultural similarities to the nearby northern Great Basin and Mountain tradition cultures and may well have had the greatest influences from these areas. Thus, such attributes as pithouses, heavy utilization of tools, predominant use of local lithic materials, various multifunction tipped and notched tools, larger side-notched bifaces as well as general forms of McKean Lanceolate, Duncan and Hanna projectile point types may indicate connections to these other traditions.

Subsequently, variation within McKean seems to relate to both spatial and temporal differences, in addition to localized adaptations. It seems that McKean may best be described as a tradition. At least two main temporal configurations may be indicated in this tradition based on the differences of projectile point styles through time. An Early McKean configuration is associated with McKean Lanceolate point types but may also contain Duncan point types, albeit to a lesser degree. A Late McKean configuration is associated with dominant Hanna point types and may also include Duncan point types, as well as other Early Side-notched point types. The age spans for these configurations varies across the Plains. Within the study area calibrated radiocarbon dates indicate that the Early McKean may range from about 5000 to 3800 calendar years B.P., while the Late McKean may tend to span between 4200 to 3300 calendar years B.P. Morlan (1993: 39) indicates a similar range from Saskatchewan radiocarbon dates of about 4450 to 3440 rcy B.P. for Early McKean and 3770 to 3000 rcy B.P. for Late McKean.

During both these temporal configurations regional composites may be recognized. A Southern McKean composite may be based on the presence of manos and metates and substantial rock-lined hearths used for the purposes of plant processing. A Northern McKean composite may lack these extreme plant-focused characteristics, although the flotation evidence from the Redtail site suggests that such resources are not ignored. These groupings may be further subdivided into localized complexes associated with areas such as the Nipawin

McKean complex, a Saskatoon McKean complex, an Elbow McKean complex, and an Old Channel Lake complex (a subphase identified at the Cactus Flower site). These taxonomic proposals may help organize comparisons and thus be more useful framework for organizing future research.

9.4) Suggestions for Future Research

Further recommendations for work at the Redtail site includes the completion of analyses for the upper layers. Further studies should include flotation analyses, so that we may better understand the uses of features. More detailed spatial distribution analyses are also necessary. Refined studies may employ three-point provenience, quadrant resolution and material size groupings from the existing data.

A recent correspondence with the Durham University TL Dating Laboratory has indicated that the hearth soil sample in layer 8 may yet be dateable. This is possible through some recent experimentation with the original sample and other similar silt-based soils. Therefore, another sample from this hearth could be submitted. Samples from layers 8 and 10 should also be submitted for radiocarbon dating. This could better delineate the upper age boundary for these occupations.

Further excavations at the site may focus on the other portion of the possible pithouse structure in layer 8. More evidence is needed to determine exactly what this structure is. It is also unfortunate that more of layer 15 was not sampled before the block's walls collapsed. The 5000 rcy B.P. age associated with layer 15, and the cultural material indicate that future study of these occupations may be fruitful. Further excavations may also produce diagnostics and other information for the poorly known material cultures between Besant and McKean.

A few major research problems arose from the present study. First, the present taxonomic systems used on the Plains is a concern for archaeology on the whole. The combined effort of many individuals from different areas of the Plains is required to overhaul the system. The proposed use of Syms's (1977) framework may be considered as an alternative to the present muddle.

Further studies of collections, and block area sampling of the deeper McKean and Hanna components is required. Such sampling has proved valuable in delineating activity patterns and structures at several McKean tradition sites, but more information is needed to fully understand these patterns. In order to interpret features, a priority must also be made to collect flotation samples and analyze them. The continued search for stratified McKean sites may provide corroborative or refined information on Oxbow and Pelican Lake relations with McKean. However, it seems that less stratified non-riparian locations may contain important McKean kill sites (e.g. Sullivan site). Future research should also expand on this little known aspect of McKean adaptation.

REFERENCES CITED

Acton, D.F. and J.G. Ellis
1978 *The Soils of the Saskatoon Map Area 73-B Saskatchewan. Saskatchewan Institute of Pedology, Publication S4* University of Saskatchewan, Saskatoon.

Adam, D.P. and G.J. West
1983 Temperature and Precipitation Estimates through the Last Glacial Cycle from Clear Lake, California, Pollen Data. *Science* 219:168-170.

Adams, James and Joanne Mack
1970 A Report on 48-SW-303. *The Wyoming Archaeologist* 13 (2): 19-28.

Adams, Jenny L.
1988 Use-Wear Analyses on Manos and Hide-Processing Stones. *Journal of Field Archaeology* 15 (3): 307-315.

Amundson, Leslie J.
1986 *The Amisk Site: A Multi-Component Campsite in South-Central Saskatchewan*. Unpublished Masters thesis, Department of Anthropology and Archaeology, University of Saskatchewan, Saskatoon.

1991 Particle-size analysis of samples from the Redtail site. Report submitted to C. Ramsay.

Anonymous
1959 48JO301 the Sweem-Taylor site. *The Wyoming Archaeologist* 2(7): 1-2.

Arthur, George
1985 *A Buffalo Round-up: A Selected Bibliography*. Canadian Plains Research Center, University of Regina, Regina.

Baillif, Ian
1988 *Guide to the Durham TL Dating Service*. T.L. Dating Laboratory, Durham University, England.

Banfield, A.W.F.
1987 [1974] *The Mammals of Canada*. University of Toronto Press, Toronto.

Barnosky, C.W.
1984 Late Pleistocene and Early Holocene Environmental History of Southwestern Washington State, U.S.A. *Canadian Journal of Earth Sciences* 21: 619-629.

Barsness, Larry
1985 *Heads, Hides and Horns: The Compleat Buffalo Book*. Texas Christian University Press, Fort Worth.

Beaudoin, Alwynne B.
1987 Alberta Radiocarbon Dates 1986-1987. Archeaological Survey of Alberta Occasional Paper No. 32, pp. 159-167. Alberta Culture Historical Division, Edmonton.

Beck, W.H.
1958 *A Guide to Saskatchewan Mammals*. Saskatchewan Natural History Society and the Saskatchewan Museum of Natural History, Regina.

Behrensmeyer, A.K.
1978 Taphonomic and ecologic information from bone weathering. *Paleobiology* 5: 15-21.

Behrensmeyer, A.K. and A.P. Hill (eds.)
1980 *Fossils in the Making*. University of Chicago Press, Chicago.

Benedict, James B.
1975 The Albion Boardinghouse site: Archaic Occupation of a High Mopuntain Valley. *Southwestern Lore* 41(3): 1-12.

1978 The Mount Albion Complex and the Altithermal. In, *The Mount Albion Complex*, by J.B. Benedict and B.L. Olson, pp. 139-180. Center for Mountain Archaeology Research Report, no. 1. Ward, Colorado.

1979 Getting Away from it all: A study of Man, Mountains, and the Two Drought Altithermal. *Southwestern Lore* 45(3):1-12.

1981 *The Fourth of July Valley: Glacial Geology and Archaeology of the Timberline Ecotone*. Center for Mountain Archaeology, Research Report 2. Ward, Colorado.

Benedict, James B. and Byron L. Olson
1973 Origins of the McKean Complex: Evidence from Timberline. *Plains Anthropologist* 18 (62): 323-327.

Benn, David W. (ed.)
1990 *Woodland Cultures on the Western Prairies: The Rainbow Site Investigations*, Report 18. Office of the State Archaeologist, University of Iowa, Iowa City.

Bentzen, Raymond C.
1962 The Powers-Yonkee Bison Trap. *Plains Anthropologisit* 7 (16): 113-118.

1963 The Bentzen-Little Bald Mountain Site. *Plains Anthropologist* 8 (18): 41-51.

Binford, Lewis R.
1963 A Proposed Attribute List for the Description and Classification of Projectile Points. *Anthropological Papers* 19: 193-221. Museum of Anthropology, University of Michigan.

1967 Smudge pits and hide smoking: the use of analogy in archaeological reasoning. *American Antiquity* 32(1): 1-12.

1978 *Nunamiut Ethnoarchaeology*. Academic Press, New York.

1981 *Bones: Ancient Men and Modern Myths*. Academic Press, Orlando.

Bird, Ralph D.
1961 Ecology of the Aspen Parkland of Western Canada in Relation to Land Use. *Canada Department of Agriculture, Research Branch*, Publication 1066.

Black, Kevin D.
1991 Archaic Continuity in the Colorado Rockies: The Mountain Tradition. *Plains Anthropologist* 36 (133): 1-29.

Bliss, Wesley L.
1950 Birdshead Cave, A Stratified Site in Wind River Basin, Wyoming. *American Antiquity* 15 (3): 187-196.

Blumenschine, Robert J.
1988 An Experimental Model of the Timing of Hominid and Carnivore Influence on Archaeological Bone Assemblages. *Journal of Archaeological Science* 15(5): 483-502.

Bonner, Wayne Howard
1985 *Smoking Pipes and Sucking Tubes of Prehistoric California: A Distributional and Typlogical Study*. Unpublished M.A. thesis, California State University, Long Beach.

Bonnichsen, Robson

1977 *Models for Deriving Cultural Information from Stone Tools*. National Museum of Man Mercury Series Paper No. 60. Archaeological Survey of Canada, National Museums of Canada, Ottawa.

Bordes, Francois

1969 Reflections on Typology and Techniques in the Paleolithic. *Arctic Anthropology* 6: 1-29.

1971 "Comments" in Respect to "Stone Age Typology: Another Approach." by D. Cahen and F. van Noten. *Current Anthroplogy* 12: 212.

Bradley, Bruce A.

1975 Lithic Reduction Sequences: A Glossary and Discussion. In, *Lithic Technology: Making and Using Stone Tools* edited by E. Swanson, pp. 5-13. Mouton Publishers, The Hague.

Brink, Jack

1978 *An Experimental Study of Microwear Formation on Endscrapers*. National Museum of Man Mercury Series Paper No. 60. Archaeological Survey of Canada, Ottawa.

1986 *Dog Days in Southern Alberta* Archaeological Survey of Alberta Occasional Paper No. 28. Alberta Culture Historical Resources Division, Edmonton.

1992 Bison Preferences: the Quest for Fat. Colloquium at the Department of Anthropology and Archaeology, University of Saskatchewan, Saskatoon.

Browne, J.

1940 Projectile Points. *American Antiquity* 5: 209-213.

Brubaker, Linda B.

1986 Responses of Tree Populations to Climatic Change. *Vegetatio* 67: 119-130.

Brumley, John H.

1973 Quantitative methods in the analysis of butchered faunal remains. *Archaeology in Montana* 14(1): 1-40.

1975 *The Cactus Flower Site in Southeastern Alberta:1972-1974 Excavations*. Archaeological Survey of Canada Paper No. 6, National Museum of Man, Ottawa.

1984 The Laidlaw Site: An aboriginal antelope trap from southeastern Alberta. Archaeological Survey of Alberta, Occasional Paper 23, pp. 96-127. Edmonton.

1986 A radiocarbon date from the Laidlaw site, DlOu-7. Archaeological Survey of Alberta, Occasional Paper 29, pp. 205-206. Edmonton.

1990 A Procedural Approach for the Description of Bison Mandibles and Dentition. Unpublished manuscript on file at Ethos Consultants, Ltd., Havre, Montana.

Brumley, John H. and Barry J. Dau
1988 *Historical Resource Investigations Within the Forty Mile Coulee Reservoir*. Archaeological Survey of Alberta Manuscript Series No. 13. Alberta Environment and Alberta Culture and Multiculturalism, Edmonton.

Brumley, John H. and Carol Rushworth
1983 A Summary and Appraisal of Alberta Radiocarbon Dates. In *Archaeology in Alberta 1982*, compiled by D. Burley, pp. 142-160. Archaeological Survey of Alberta Occasional Paper 21. Alberta Culture Historical Resources Division, Edmonton.

Bryson, R.A., D.A. Baerreis and W.M. Wendland
1970 The Character of Late-Glacial and Post-Glacial Climatic Changes. In *Pleistocene and Recent Environments of the Central Great Plains*, Special Publication 3, edited by Wakefield Dort Jr. and J. Knox Jones Jr., pp. 53-74. University Press of Kansas, Kansas.

Buchner, A. P.
1980 Cultural Responses of the Altithermal (Atlantic) Climate Along the Eastern Margins of the North American Grasslands 5500 to 3000 B.C. *National Museum of Man, Archaeological Survey of Canada, Mercury Series* 67. Ottawa.

Byers, A.R., W. G. E. Caldwell, and W. O. Kupsch
1969 Evolution of the Present Bedrock Surface. In *Atlas of Saskatchewan*, edited by J. Howard Richards and K. I. Fung, pp. 44-45. University of Saskatchewan, Saskatoon.

Calder, James M.
1977 The Majorville Cairn and Medicine Wheel Site, Alberta. *National Museum of Man Mercury Series, Archaeological Survey of Canada* 14. Ottawa.

Canada Department of Agriculture

1974 *A System of Soil Classification for Canada*. Agriculture Canada Publication 1455. Information Canada, Ottawa.

Cannon, Debbi Yee

1987 *Marine Fish Osteology: A Manual for Archaeologists*. Publication No. 18. Archaeology Press, Simon Fraser University, Burnaby.

Carbone, Victor A. and Bennie C. Keel

1985 Preservation of Plant and Animal Remains. In *The Analysis of Prehistoric Diets*, pp. 1-19. Academic Press, New York.

Chakravarti, A.K.

1969 The Climate of Saskatchewan. In *Atlas of Saskatchewan*, edited by J. H. Richards and K. I. Fung, p. 60. University of Saskatchewan, Saskatoon.

Chomko, Stephen A.

1980 Identification of North American Rodent Teeth. In *Mammalian Osteology*, by B. Miles Gilbert, pp. 72-99.

Christenson, Andrew L.

1986 Projectile Point Size and Projectile Aerodynamics: An Exploratory Study. *Plains Anthropologist* 31(112): 109-128.

Crabtree, Don

1972 An Introduction to Flintworking. *Occassional Papers of the Idaho State Museum* No. 28: 1-17.

Craighead, J., F.C. Craighead and R.J. Davis

1963 *A Field Guide to Rocky Mountain Wildflowers*. Houghton Mifflin Co., Boston.

Craigie, Terri L.

1985 Wyoming Radiocarbon Dates. *The Wyoming Archaeologist* 28 (1-2): 39-60.

Davis, Lesie B.

1976 The Dodge Site (24RB1225): A McKean Phase Lithic "Cache" in the Tongue River Valley. *Archaeology in Montana* 17: 35-51.

Deck, D.

1992 Redtail Creek site (FbNp-10): Flotation Analysis. Report submitted to C. Ramsay.

Deetz, James
1967 *Invitation to Archaeology*. The Natural History Press, Garden City, New York.

Densmore, Frances
1974 *How Indians Use Wild Plants for Food, Medicine and Crafts*. Dover Publications Inc., New York.

Driesch, Angela von den
1976 *A Guide to the Measurement of Animal Bones from Archaeological Sites*. Peabody Museum Bulletin No. 1. Peabody Museum of Archaeology and Ethnology, Harvard University, Cambridge.

Dyck, Ian
1970 Two Oxbow Settlement Types in Central Saskatchewan. *Napao: A Saskatchewan Anthropology Journal* 2(2): 1-29.

1983 Prehistory of Southern Saskatchewan. In *Tracking Ancient Hunters: Prehisoric Archaeology in Saskatchewan*, edited by Henry T. Epp and Ian Dyck, pp. 63-139. Saskatchewan Archaeological Society, Regina.

Dyck, Ian, K. Elliott and I.G. Brace
1980 Initial work at the Sjovold site, Saskatchewan. Poster session at the 13th annual meeting of the Canadian Archaeological Association. Saskatoon, Saskatchewan.

Ericson, J.E.
1984 Towards the Analysis of Lithic Production Systems. In *Prehistoric Quarries and Lithic Production*, edited by J.E. Ericson and B.A. Purdy, pp. 1-9.

Epp, Henry T.
1986 Prehistoric Settlement Response to the Harris Sand Hills, Saskatchewan, Canada. *Plains Anthropologist* 31(111): 51-63.

Ewers, John C.
1955 The Horse in Blackfoot Indian Culture, with Comparative Material from Other Western Tribes. Bureau of american Ethnology, *Bulletin* 159. Washington.

Fawcett, William B. Jr. and Marcel Kornfeld
1980 Projectile Point Neck-Width Variability and Chronology on the Plains. *Wyoming Contributions to Anthropology* 2: 66-79.

Ferring, C. Reid
1984 Intrasite Spatial Patterning: Its Role in Settlement-Subsistence Systems Analysis. In *Intrasite Spatial Analysis in Archaeology*, edited by Harold Hietala, pp. 116-126. Cambridge University Press, Cambridge.

Ferris, William
1989 Rafferty Taxonomy Catalogue Program, Revised. Western Heritage Services Ltd., Saskatoon.

Finnigan, James T.
1982 Tipi Rings and Plains Prehistory: A reassessment of their Archaeological Potential. National Museum of Man Mercury Series, *Paper* 108. National Museums of Canada, Ottawa.

1985 Fieldnotes from the Excavations at the Broken Axle site (FhNc-81) for the period June 28 to July 31, 1985. On file at Western Heritage Services, Ltd., Saskatoon.

Finnigan, James T., David Burley, David Meyer, Peggy McKeand, Margaret Greene, Olga Klimko and Dale Russell
1985 *Operational and Analysis Guidelines for the Archaeology Reserach Group.* Publication No. E-903-17-E-85. Saskatchewan Research Council, Saskatoon.

Finnigan, James T., David Meyer and Jean Prentice
1983 *Nipawin Reservoir Heritage Study: Resource Inventory, Assessment and Evaluation,* Volume 5, SRC Publication No. E-903-9-E-83. Saskatchewan Research Council, Saskatoon.

Flannery, Kent V.
1967 The Vertebrate Fauna and Hunting Patterns. In *The Prehistory of the Tehuacan Valley,* Vol. 1, edited by D.S. Byers, pp. 132-178. University of Texas Press, Austin.

Flenniken, J. Jeffrey
1985 Stone Tool Reduction Techniques as Cultural Markers. In *Stone Tool Analysis: Essays in Honour of Don E. Crabtree*, edited by Mark G. Plew, James C. Woods and Max G. Pavesic, pp. 265-276. University of New Mexico Press, Albuquerque.

Flenniken, J. Jeffrey and Terry L. Ozbun
1988 Experimental Analysis of Plains Grooved Abraders. *Plains Anthropologist* 33 (119): 37-52.

Flenniken, J. Jeffrey and Anan Raymond
1986 Morphological Projectile Point Typology: Replication, Experimentation and Technological Analysis. *American Antiquity* 51: 603-614.

Forbis, Richard G.
1985 The McKean Complex as Seen from Signal Butte. In *McKean/Middle Plains Archaic: Current Research*, edited by Marcel Kornfeld and Lawrence C. Todd, pp. 21-29. Occasional Papers on Wyoming Archaeology No. 4, Laramie, Wyoming.

Forbis, Richard G., William Duncan Strong and Maurice Kirby
n.d. Signal Butte and MacHaffie: Two Stratified Sites on the Northern Great Plains. Ms. in possession of the author.

Francis, Julie E.
1980 Lithic raw material procurement and utilization as an indicator of changes in hunter-gatherer subsistence and settlement. *Wyoming Contributions to Anthropology* 2 (spring): 1-15.

Frison, George C.
1962 Wedding of the Waters Cave, 48H0301, A Stratified Site in the Big Horn Basin of Northern Wyoming. *Plains Anthropologist* 7 (18): 246-265.

1978 *Prehistoric Hunters of the High Plains*. Academic Press, New York.

1991 *Prehistoric Hunters of the High Plains*, second edition. Harcourt Brace Jovanovich, New York.

Frison, George C. and Marion Huseas
1968 Leigh Cave, Wyoming, Site 48SW304. *The Wyoming Archaeologist* 11 (3): 20-33.

Frison, George C. and Zola Van Norman
1993 Carved Steatite and sandstone Tubes: Pipes for Smoking or Shaman's Paraphernalia? *Plains Anthropologist* 38(143): 163-176.

Frison, George C. and Charles A. Reher
1970 Appendix I: Age Determinatin of Buffalo by Teeth Eruption and Wear. In *The Glenrock Buffalo Jump 48C0304: Late Prehistoric Period Buffalo Procurement and Butchering in the Northwestern Plains*, edited by George C. Frison, pp. 46-50. *Plains Anthropologist Memoir* 7.

Frison, George C. and Danny Walker (eds.)

1984 The Dead Indian Creek Site: An Archaic Occupation in the Absaroka Mountains of Northeastern Wyoming. *The Wyoming Archaeologist* 27(1-2): 1-122.

Gant, Robert and Wesley Hurt

1965 The Sturgis archaeological project: an archaeological survey of the Black Hills. *South Dakota Museum News* 26(7-8): 1-51.

Gibson, Terrance H.

1991 MacADEM: Archaeological Data Entry and Management Software for the Apple MacIntosh computer. Western Heritage Services Inc. 563-5th Ave. N., Saskatoon, Saskatchewan, Canada S7K 2R1 (306) 975-3864.

Gifford, Diane P.

1978 Ethnoarchaeological Observations of Natural Processes Affecting Cultural Materials. In *Explorations in Ethnoarchaeology*, edited by R.A. Gould, pp. 77-101. University of New Mexico Press, Albuquerque.

1980 Ethnoarchaeological Contributions to the Taphonomy of Human Sites. In *Fossils in the Making: Vertebrate Taphonomy and Paleoecology*, edited by A.K. Behrensmeyer and A.P. Hill, pp. 93-106. University of Chicago Press, Chicago.

1982 Taphonomy and Paleoecology: A Critical Review of Archaeology's Sister Disciplines. In *Advances in Archaeological Method and Theory* vol. 4, edited by Michael B. Schiffer, pp. 365-438. Academic Press, New York.

Gifford, Diane P. and A.K. Behrensmeyer

1977 Observed Depositional Events at a Modern Human Occupation Site in Kenya. *Quaternary Research* 8: 245-266.

Gilbert, B. Miles

1969 Some Aspects of Diet and Butchering Techniques Among Prehistoric Plains Indians in South Dakota. *Plains Anthroplogist* 14(46): 277-294.

1980a *Mammalian Osteology*. B. Miles Gilbert Publishing, Laramie, Wyoming.

1980b The Plains Setting. In *Anthropology on the Great Plains*, edited by W. Raymond Wood and Margot Liberty, pp. 8-15. University of Nebraska Press, Lincoln.

Gilmore, M. R.
1919 *Uses of Plants by the Indians of the Missouri River Region*. Bureau of American Ethnology Annual Report 33.

Godfrey, Earl W.
1986 *The Birds of Canada: Revised Edition*. National Museum of Natural Sciences, National Museums of Canada, Ottawa.

Gordon, B.
1976 *Migod - 8,000 years of Barrenland Prehistory*. National Museum of Man Mercury Series, Archaeological Survey of Canada Paper No. 56. Ottawa.

Grayson, Donald K.
1981 The Effects of Sample Size on Some Derived Measures in Vertebrate Faunal Analysis. *Journal of Archaeological Science* 8: 77-88.

1984 *Quantitative Zooarchaeology: Topics in the Analysis of Archaeological Fauna*. Academic Press, New York.

Green, James P.
1975 McKean and Little Lake Technology: A Problem in Projectile Point Typology in the Great Basin in North America. In *Lithic Technology: Making and Using Stone Tools*, edited by Earl Swanson, pp. 159-171. Mouton and Company, The Haugue, Netherlands.

Grey, Don C.
1962 The Bentzen-Kaufmann Cave Site. *Plains Anthropologist* 7 (18): 237-245.

Grinnell, George Bird
1977 *The Cheyenne Indians: History and Society, Volume* I. University of Nebraska Press, Lincoln. [1923].

Gruhn, Ruth
1961 *The Archaeology of Wilson Butte Cave, South Central Idaho.* Idaho State College Museum Occasional Paper 6, Pocatello.

1969 Summary of Field Work at Calling Lake, Northern Alberta, Summer 1968. *Archaeological Society of Alberta Newsletter*, No. 19: 8-14.

Hanson, Bruce
1980 Fluvial Taphonomic Processes: Models and Experiments. In *Fossils in the Making: Vertebrate Taphonomy and Paleoecology* edited by A.K. Behrensmeyer and A.P. Hill, pp. 156-181. University of Chicago Press, Chicago.

Harrington, H.D.
1972 *Western Edible Wild Plants*. University of New Mexico Press, Albuquerque.

Harris, W.C., A. Kabzems, A.L. Kosowan, G.A. Padbury and J.S. Rowe
1983 *Ecological Regions of Saskatchewan*. Technical Bulletin No. 10, Forestry Division, Saskatchewan Parks and Renewable Resources.

Haug, James K.
1976 *The 1974-1975 Excavations at the Cherry Point Site (DkMe-10): A Stratified Archaic Site in Southwest Manitoba.* Papers in Manitoba Archaeology, Department of Tourism, Recreation and Cultural Affairs, Historic Resources Branch, Manitoba.

Hayden, Brian (editor)
1979 *Lithic Use-Wear Analysis*. Academic Press, New York.

Helleson, J.C. and M. Gadd
1974 *Ethnobotany of the Blackfoot Indians*. Canadian Ethnology Service Paper 19. National Museum of Man Mercury Series, Ottawa.

Hilderman, Witty, Crosby, Hanna and Associates Landscape Architects and Planners
1986 Wanuskewin Heritage Park Resource Management Plan. Ms. on file, Meewasin Valley Authority, Saskatoon.

Hill, Andrew
1979 Butchery and Natural Disarticulation: An Investigatory Technique. *American Antiquity* 44(4): 739-744.

1980 Early Postmortem Damage to the Remains of some Contemporary East African Mammals. In *Fossils in the Making: Vertebrate Taphonomy and Paleoecology* edited by A.K. Behrensmeyer and A.P. Hill, pp. 131-152. University of Chicago Press, Chicago.

Hill, M.W.
1948 The Atlatl or Throwing Stick: A Recent Study of Atlatls in Use with Darts of Various Sizes. *Tennessee Archaeologist* 4 (4): 37-44.

Hoebel, E. Adamson
1980 The Influence of Plains Ethnography on the Development of Anthropological Theory. In *Anthropology on the Great Plains*, edited by W. Raymond Wood and Margot Liberty, pp. 16-22. University of Nebraska Press, Lincoln.

Holmer, Richard N.
1978 *A Mathematical Typology for Archaic Projectile Points of the Eastern Great Basin*. Unpublished Ph.D. dissertation, Department of Anthropology, University of Utah, Salt Lake City.

Hudson, John
1988 Vascular Floral Additions, Wanuskewin Heritage Park Inventory of Vascular Flora. Unpublished Manuscript based on botany tour of the Saskatoon Natural History Society, June 15, 1988. Ms. on file, Meewasin Valley Authority.

Husted, Wilfred M.
1968 The Western Macrotradition: Mountains-Plains division. Paper presented at the Plains Conference, Lincoln.

1969 Bighorn Canyon Archaeology. *Smithsonian Institution River Basin Surveys, Publications in Salvage Archaeology* 12. Smithsonian Institution.

Jennings, Jesse D.
1957 *Danger Cave*. Society of American Archaeology Memoir 13 (2).

1968 *Prehistory of North America*. McGraw-Hill, New York.

Jennings, Jesse D., Alan R. Schroedl and Richard N. Holmer
1980 *Sudden Shelter*. University of Utah Anthropological Papers No. 103, Salt Lake City.

Jochim, Michael S.
1981 *Strategies for Survival: Cultural Behavior in an Ecological Context*. Academic Press, New York.

Johnson, Eileen
1985 Current Developments in Bone Technology. In *Advances in Archaeological Method and Theory* Vol. 8, edited by Michael B. Schiffer, pp. 157-235. Academic Press, New York.

Johnson, Eldon A.
1975 The Sullivan Site. *Saskatchewan Archaeology Newsletter* 49: 9-15.

1986 *Properties and Sources of Some Saskatchewan Lithic Materials of Archaeological Significance*. Unpublished Master's thesis, Department of Anthropology and Archaeology, University of Saskatchewan, Saskatoon.

Johnson, Ian
1984 Cell Frequency Recording and Analysis of Artifact Distributions. In *Intrasite Spatial Analysis in Archaeology*, edited by Harold J. Hietala, pp. 75-96. Cambridge University Press, Cambridge.

Johnson, Jay K.
1993 North American Biface Production Trajectory Modeling in Historic Perspective. *Plains Anthropologist* 38 (143): 151-162.

Jones, Kevin T. and Duncan Metcalfe
1988 Bare Bones Archaeology: Bone Marrow Indices and Efficiency. *Journal of Archaeological Science* 15(4): 415-423.

Kehoe, Alice B. and Thomas F. Kehoe
1979 Solstice-aligned Boulder Configurations in Saskatchewan. *Canadian Ethnology Service*, Paper No. 48. National Museum of Man, Ottawa.

Kelly, David L.
1986 *The Newo Asiniak Site: A Multicomponent Bison Procurement Site in Central Saskatchewan*. Unpublished Master's thesis, Department of Anthropology and Archaeology, University of Saskatchewan, Saskatoon.

Kent, Susan
1984 *Analyzing Activity Areas: An Ethnoarchaeological Study of the Use of Space*. University of New Mexico Press, Albuquerque.

Keyser, James D.
1982 A Comparative Analysis of Two McKean Phase Occupations in the Grand River Drainage. *Journal of North Dakota Archaeological Association* 1: 31-41.

1985 The Archaeological Identification of Local Populations: A Case Study from the Northwestern Plains. *Plains Anthropologist* 30(108): 85-102.

1986 The Evidence for McKean Complex Plant Utilization. *Plains Anthropologist* 31 (113): 225-235.

Keyser, James D. and Carl M. Davis
1985 Lightning Spring and Red Fox: McKean Research in the Grand River Drainage. In *McKean/Middle Plains Archaic: Current Research*, edited by Marcel Kornfeld and Lawrence C. Todd, pp. 123-136. Occasional Papers on Wyoming Archaeology No. 4, Laramie, Wyoming.

Keyser, James D. and John L. Fagan
1987 ESP: Procurement and Processing of Tongue River Silicified Sediment. *Plains Anthropologist* 32 (117): 233-256.

1989 McKean Lithic Technology at Lightning Spring. Paper presented at the 47th Plains Conference, Sioux Falls, South Dakota.

Klein, Richard G. and Kathryn Cruz-Uribe
1984 *The Analysis of Animal Bones from Archaeological Sites*. University of Chicago Press, Chicago.

Knight, George C. and James D. Keyser
1983 A Mathematical Technique for Dating Projectile Points Common to the Northwestern Plains. *Plains Anthropologist* 28(101): 199-217.

Kornfeld, Marcel and George C. Frison
1985 McKean Site: A 1983 Preliminary Analysis. In *McKean/Middle Plains Archaic: Current Research*, edited by Marcel Kornfeld and Lawrence C. Todd, pp. 31-44. Occasional Papers on Wyoming Archaeology, No. 4, Laramie, Wyoming.

Kornfeld, Marcel and George C. Frison (editors)
1988 Keyhole Reservoir Archaeological Study. Ms. Draft of Final Report, Department of Anthropology, University of Wyoming, Laramie.

Kornfeld, Marcel and Lawrence C. Todd (eds.)
1985 McKean/Middle Plains Archaic: Current Research. *Occasional Papers on Wyoming Archaeology* 4. Office of the Wyoming State Archaeologist, Laramie, Wyoming.

Kra, Renee
1986 Standardizing Procedures for Collecting, Submitting, Reporting, and Recording Radiocarbon Samples. *Radiocarbon* 28 (2A): 765-775.

Krieger, AlexD.
1944 The Typology Concept. *American Antiquity* 9(3): 271-288.

1956 Archaeology in Theory and Practice, In *Men and Cultures*, edited by A.F. Wallace, University of Philadelphia Press, Philadelphia.

Kupsch, W. O.
1969 Glacial Geology (Quaternary) of Saskatchewan. In, *Atlas of Saskatchewan* edtied by J.H. Richards and K.I. Fung, pp. 48-51. University of Saskatchewan, Saskatoon.

Leney, Lawrence and Richard W. Casteel
1975 Simplified Procedure for Examining Charcoal Specimens for Identification. *Journal of Archaeological Science* 2: 153-159.

Leroi-Gourhan, A. and M. Brezillon
1972 Fouilles de Pincevent. Essai d'analyse ethnographique d'un habitat magdalenein (la section 36). *Gallia Prehistoire*, supplement VII. CNRS, Paris.

Lister, Robert H.
1951 The Stemmed Indented Base Point, A Possible Horizon Marker. *American Antiquity* 18: 264-265.

Lobdell, John E.
1973 The Scoggin Site: An Early Middle Period Bison Kill. *The Wyoming Archaeologist* 16 (3 and 4).

1974 The Scoggin Site: A Study in McKean Typology. *Plains Anthropologist* 19 (64): 123-128.

Lowie, Robert H.
1985 [1954] *Indians of the Plains*. University of Nebraska Press, Lincoln.

Lyman, R. Lee
1978 Prehistoric Butchering Techniques in the Lower Granite Reservoir, southeastern Washington. *Tebiwa* 13.

1984 Bone density and differential survivorship of fossil classes. *Journal of Anthropological Archaeology* 3: 259-299.

1992 Anatomical Considerations of Utility Curves in Zooarchaeology. *Journal of Archaeological Science* 19(1): 7-22.

Lyman, R. Lee and Gregory L. Fox
1989 A Critical Evaluation of Bone Weathering as an Indicator of Bone Assemblage Formation. *Journal of Archaeological Science* 16(3): 293-317.

MacNeish, Richard S.
1958 *An Introduction to the Archaeology of Southeastern Manitoba*. Bulletin 157, Department of Northern Affairs and Indian Development, National Museums of Canada, Ottawa.

Mandelbaum, David G.
1979 *The Plains Cree: An Ethnographic, Historical, and Comparative Study.* Canadian Plains Studies 9, edited by J. Archer. Canadian Plains Research Center, University of Regina, Regina.

Marean, Curtis W.
1991 Measuring the Post-depositional Destruction of Bone in Archaeological Assemblages. *Jounal of Archaeological Science* 18: 677-694.

Marks, Stuart A.
1976 *Large Mammals and a brave people: Subsistence hunters in Zambia.* University of Washington Press, Seattle.

Marshall, Fiona and Tom Pilgrim
1993 NISP vs. MNI in Quantification of Body-Part Representation. *American Antiquity* 58(2): 261-269.

Mathews, R.W.
1985 Paleobotanical Evidence for Climatic Change in Southern British Columbia During Late-Glacial and Holocene Time. In *Climatic Change in Canada* 5, edited by C.R. Harington, pp.397-422 (Syllogeus No.55). National Museums of Canada, Ottawa.

Mathews, R.W. and L.E, Heusser
1981 A 12,000 Year Palynological Record of Temperature and Precipitation Trends in Southwestern British Columbia. *Canadian Journal of Botany* 59: 707-710.

Mayer-Oakes, William J.
1970 *Archaeological Investigations in the Grand Rapids, Manitoba, Reservoir, 1961-1962*. Occasional Paper No. 3, Department of Anthropology, University of Manitoba Press, Winnipeg.

MacDonald, G. M. and J. C. Ritchie
1986 Modern pollen spectra from the Western Interior of Canada and the interpretation of Late Quaternary vegetation development. *New Phytologist* 103: 245-268.

McDonald, J.N.
1981 *The North American Bison: Their Classification and Evolution*. University of California Press, Berkeley.

McHugh, Tom
1972 *The Time of the Buffalo*. Alfred A. Knopf, New York.

1958 Social Behavior of the American Buffalo (*Bison bison bison*). *Zoologica* 43.

McKeand, P. and T.H. Gibson
1992 FNL Taxa: Vol. 1.4. © Western Heritage Services Inc. Saskatoon, Canada.

McKern, W.C.
1939 The Midwestern Taxonomic Method as an Aid to Archaeological Culture Study. *Amercian Antiquity* IV(4): 301-313.

Meyer, David
1981 Late Prehistoric Assemblages from Nipawiwin: the Pehonan Complex. *Saskatchewan Archaeology* 2(1-2): 4- 38.

1983 Prehistory of Northern Saskatchewan. In *Tracking Ancient Hunters: Prehistoric Archaeology in Saskatchewan*, edited by Henry T. Epp and Ian Dyck, pp. 141-170. Saskatchewan Archaeological Society, Regina.

Meyer, David and Ian Dyck
1968 The Connell Creek site. *Saskatchewan Archaeology Newsletter* 23: 2-9.

Meyer, David and Dale Russell
1990 North-South Interaction in the Late Prehistory of Central Saskatchewan. *Plains Anthropologist* 35(132): 321-342.

Michels, Joseph W.
1973 *Dating Methods in Archaeology*. Seminar Press, New York.

Millar, J.F.V.
1978 *The Gray Burial Site: An Early Plains Burial Ground*. Parks Canada Manuscript Report 304.

Millar, J.F.V., H. Epp, T.W. Foster, J.S. Wilson and G. Adams
1972 The Southwestern Saskatchewan Archaeological Project: Preliminary Report, 1971. *Na'pao: A Saskatchewan Anthropology Journal* 3(2): 1-39.

Miller, Susanne J.
1972 Weston Canyon Rockshelter: big-game hunting in southeastern Idaho. Unpublished Master's thesis, Idaho State University, Pocatello.

Morlan, Richard E.
1991 Bison Carpal and Tarsal Measurements: Bulls versus Cows and Calves. *Plains Anthropologist* 36 (136): 215-227.

1992a Appendix 2. Bison Size and Gender at the Gowen Sites. In *The Gowen Sites: Cultural Responses to Climatic Warming on the Northern Plains (7500-5000 B.P.)* by Ernest G. Walker, pp. 203-208.

1992b Rodent Bones in Archaeological Sites. Paper presented at the 25th Annual Meeting of the Canadian Archaeological Association, London, Ontario.

1993 A Compilation and Evaluation of Radiocarbon Dates in Saskatchewan. *Saskatchewan Archaeology* 13: 3-84.

Mott, R.J.
1972 *Palynological Studies in Central Saskatchewan: Pollen Stratigraphy from Lake Sediment Sequences.* Geological Survey of Canada Paper 72-49. Department of Energy, Mines and Resources, Ottawa.

Mulloy, William T.
1943 A Prehistoric Campsite Near RedLodge, Montana. *American Antiquity* 9 (2): 170-179.

1954 The McKean Site in Northeastern Wyoming. *Southwestern Journal of Anthropology* 10(4): 432-460.

1958 *A Preliminary Historical Outline for the Northwestern Plains.* University of Wyoming Publications 22 (1): 1-235.

Munson, Gene
1990 Archaeological Investigations at 24RB1164. Unpublished report prepared for Peabody Coal Company's Big Sky Mine, Area B, Rosebud County, Montana by GCM Services Inc., Butte, Montana.

Murray, Priscilla
1980 Discard Location: the Ethnographic Data. *American Antiquity* 45(3): 490-501.

Nicholson, B.A.
1988 Modeling Subsistence Strategies in the Forest/Grassland Transition Zone of Western Manitoba During the Late Prehistoric and Early Historic Periods. *Plains Anthropologist* 33(121): 351-365.

Odell, George H.
1977 *The Application of Micro-Wear Analysis to the Lithic Component of an Entire Prehistoric Settlement: Methods, Problems, and Functional Reconstructions*. Ph.D. dissertation, Department of Anthropology, Harvard University, University Microfilms, Ann Arbor.

Olsen, Stanley J.
1985 *Origins of the Domestic Dog: The Fossil Record*. University of Arizona Press, Tucson.

Ottaway, Barbara S.
1986 Is Radiocarbon Dating Obsolescent for Archaeologists? *Radiocarbon* 28(2A): 732-738.

Parkes, P.A.
1986 *Current Scientific Techniques in Archaeology*. St. Martin's Press, New York.

Parks, Douglas R., Margot Liberty and Andrea Ferenci
1980 Peoples of the Plains. In *Anthropology on the Great Plains*, edited by W. Raymond Wood and Margot Liberty, pp. 284-295. University of Nebraska Press, Lincoln.

Pearson, G.W. and Minze Stuiver
1986 High-Precision Calibration of the Radiocarbon Time Scale, 500 - 2500 B.C. *Radiocarbon* 28 (2B): 839-862.

Pearson, G.W., J.R. Pilcher, M.G. Baillie, D.M. Corbett and F. Qua
1986 High-Precision ^{14}C Measurement of Irish Oaks to Show the Natural ^{14}C Variations from AD 1840-5210 BC. *Radiocarbon* 28 (2B): 911-934.

Pendree, Wayne
1981 Surface finds: a discussion of Harris Sand Hills materials. *Saskatchewan Archaeological Society Newsletter* 2(1): 25-27.

Plowden, D.
1972 *Floor of the Sky*. Charles Curtis, New York.

Portnoy, Alice
1981 A Microarchaeological View of Human Settlement Space and Function. In *Modern Material Culture: The Archaeology of Us* edited by R.E Gould and M.B. Schiffer, pp. 213-224. Academic Press, New York.

Prentice, Colin
1986 Vegetation Responses to Past Climatic Variation. *Vegetatio* 67: 131-141.

Quigg, J. Michael
1986 *The Crown Site (FhNa-86) Excavation Results.* Nipawin Reservoir Heritage Study Volume 8, edited by David Meyer, (SRC Publication No. E-903-7-E-86). Saskatchewan Research Council, Saskatoon.

Ramsay, Allyson M.
1991 The Melhagen Site: A Besant Bison Kill in South Central Saskatchewan. Unpublished M.A. thesis in the Department of Anthropology and Archaeology, University of Saskatchewan, Saskatoon.

Ramsay, Charles L.
1989 *The Redtail Creek site (FbNp-10) preliminary excavation results of the 1988 field season*. Submitted to the Saskatchewan Archaeological Society. Investigation Permit No. 88-24. Report on file at the Saskatchewan Archaeological Society Office, Saskatoon.

Reeves, Brian O.K.
1969 The southern Alberta paleo-cultural-paleo-environmental sequence. In *Post-Pleistocene Man and His Environment on the Plains*, edited by R.G. Forbis, L.B. Davis, O.A. Christensen and G. Fedirchuck, pp.6-46. University of Calgary Archaeological Association, Calgary.

1970 Working Papers in the Metric and Nonmetric Description and Classification of Chipped Stone Tools, 3rd Edition. Unpublished Ms. in possession of the author.

1983a *Culture Change in the Northern Plains: 1000 B.C. - A.D. 1000*. Archaeological Survey of Alberta Occasional Paper No. 20. Alberta Culture Historical Resources Division, Edmonton.

1983b McKean Origins, Dispersal and Later Relationships. Paper presented at the 41st Plains Anthropological Conference, Rapid City, South Dakota.

Reher, Charles A.
1985 Patterns of Lithic Source Utilization at the McKean Site (48CK7). In *McKean/Middle Plains Archaic: Current Research*, edited by Marcel Kornfeld and Lawrence C. Todd, pp. 95-103. Occasional Papers on Wyoming Archaeology No. 4, Laramie, Wyoming.

Richards, J. Howard
1969 Physical Features of Saskatchewan. In, *Atlas of Saskatchewan* edtied by J.H. Richards and K.I. Fung, pp. 40-41. University of Saskatchewan, Saskatoon.

Richards, J.H. and K.I. Fung (editors)
1969 *Atlas of Saskatchewan*. University of Saskatchewan, Saskatoon.

Ritchie, J.C.
1976 The Late-Quaternary Vegetational History of the Western Interior of Canada. *Canadian Journal of Botany* 54, pp. 1793-1818.

1983 The Paleoecology of the central and northern parts of the Glacial Lake Agassiz basin. In, *Glacial Lake Agassiz* edited by J.T. Teller and L. Clayton, pp. 157-170. Geological Association of Canada, Special Paper 26.

1986 Climatic Change and Vegetation Response. *Vegetatio* 67: 65-74.

Rouse, Irving
1939 *Prehistory of Haiti, A Study in Method*. Yale University Publications in Anthropology No. 21, New Haven.

1960 The Classification of Artifacts in Archaeology. *American Antiquity* 25: 313-323.

Russell, Dale R.
1991 *Eighteenth-Century Western Cree and Their Neighbours.* Archaeological Survey of Canada Mercury Series Paper 143. Canadian Museum of Civilization, Ottawa.

Salisbury, E. J. and F. W. Jane
1940 Charcoals from Maiden Castle and their Significance in Relation to the Vegetation and Climatic Conditions in Prehistoric Times. *Journal of Ecology* 28: 310-325.

Schiffer, Michael B.
1975 Archaeology as a Behavioral Science. *American Anthropologist* 77: 836-848.

1987 *Formation Processes of the Archaeological Record.* University of New Mexico Press, Albuquerque.

Schroedl, Alan D.

1976 *The Archaic of the Northern Colorado Plateau.* Unpublished Ph.D. dissertation, Department of Anthropology, University of Utah, Salt Lake City.

Schroedl, Alan D. and E.G. Walker

1978 A Preliminary Report on the Gowen site: An Early Middle Prehistoric site on the Northwest Plains. *Na'Pao* 8(1-2): 1-5.

Schultz, Jack D.

1992 The Use-wear Generated by Processing Bison Hides. *Plains Anthropologist* 37(141): 333-351.

Schweger, Charles

1987 A Critical Appraisal of the Altithermal and its Role in Archaeology. In *Man and the Mid-Holocene Climatic Optimum,* Proceedings of the 17th Annual Chacmool Conference, edited by Neil A. McKinnon and G.S.L. Stuart, pp. 371-377. University of Calgary Archaeological Association, Calgary.

Semenov, S. A.

1964 *Prehistoric Technology.* Cory Adams and Mackay Ltd., London.

1971 The Forms and Functions of the Oldest Tools. *Quartar* 21: 1-20.

Sharer, R.J. and W. Ashmore

1979 *Fundamentals of Archaeology.* The Benjamin/Cummings Publishing Company, Inc., Menlo Park, California.

Sharrock, Floyd W.

1966 *Prehistoric Occupation Patterns in Southwest Wyoming and Cultural Relationships with the Great Basin and Plains Culture Areas.* Anthropological Papers of the University of Utah No. 77.

Shay, C. Thomas

1980 Food Plants of Manitoba. *Directions in Manitoba Prehistory. Papers in Honour of Chris Vickers,* edited by L. Pettipas, pp. 233-290. Association of Manitoba Archaeologists and the Manitoba Archaeological Society, Winnipeg.

Shay, C. Thomas, S. Coyston, H. Isfeld and M. Waddell
1991 Paleobotanical Studies at the Forks: Analysis of Seeds, Charcoal and Other Organic Remains. *Manitoba Archaeological Journal* 1 (1): 62-92.

Shea, John J.
nd. Blind Tests in Lithic Use-Wear Analysis. Unpublished Ms. in possession of the author.

Siversten, Barbara J.
1980 A Site Activity Model for Kill and Butchering Activities at Hunter-Gatherer Sites. *Journal of Field Archaeology* 7 (4): 423-441.

Smart, Tistine Lee and Ellen S. Hoffman
1988 Environmental Interpretation of Archaeological Charcoal. In *Current Paleoethnobotany: Analytical Methods and Cultural Interpretations of Archaeological Plant Remains*, edited by Christine A. Hastorf and Virginia S. Popper, pp. 167-205. The University of Chicago Press, Chicago.

Spath, Carl
1987 Vegas and McKean: Two Poorly Understood Holocene Adaptations to Arid Habitats. In *Man and the Mid-Holocene Climatic Optimum*. Proceedings of the 17th Annual Chacmool Conference, edited by Neil A. McKinnon and Glenn Stuart, pp. 123-129. University of Calgary Archaeological Association, Calgary.

Spaulding, Albert C.
1953 Statistical Techniques for the Discovery of Artifact Types. *American Antiquity* 18:305-313.

1960a Statistical Description and Comparison of Artifact Assemblages. In *Application of Quantitative Methods in Archaeology*, edited by R.F. Heizer and S.F. Cook. Viking Fund Publications in Anthropology 18, New York.

1960b The Dimensions of Archaeology. In *The Science of Culture*, edited by G.E. Dole and R.L. Carneiro. Thomas Y. Crowell Company, New York.

Speth, John D.
1983 *Bison Kills and Bone Counts: Decision Making by Ancient Hunters*, University of Chicago Press, Chicago.

Stallcop, Emmett
1966 The Distribution in North-Central Montana of Variant Basally Indented Projectile Points. *Archaeology in Montana* 7 (2): 6-9.

Stevenson, Marc G.
1985 The Formation of Artifact Assemblages at Workshop/Habitation Sites: Models from Peace Point in Northern Alberta. *American Antiquity* 50 (1): 63-81.

Steward, Julian H.
1937 Ancient Caves of the Great Salt Lake Region. *Bureau of American Ethnology, Bulletin* 116. Smithsonian Institute.

Strong, William Duncan
1933 The Plains Culture Area in the Light of Archaeology. *American Anthropologist, New Series* 35 (2): 271-287.

1935 An Introduction to the Study of Nebraska Archaeology. *Smithsonian Miscellaneous Collections* 93 (10).

Stuart, Glenn S.L.
1990 *The Cranford Site (DlPb-2): A Mulicomponent Stone Circle Site on the Oldman River*. Archaeological Survey of Alberta Manuscript Series 17. Alberta Culture and Multiculturalism Historical Resources Division, Edmonton.

Stuiver, Minze and Henry A. Polach
1977 Radiocarbon 1977 Discussion Reporting of ^{14}C Data. *Radiocarbon* 19 (3): 355-363.

Stuiver, Minze and Reimer
1987 Radiocarbon Calibration Program, Rev. 2.0. Compiled with Microsoft Fortran 3.3. Quaternary Isotope Lab, University of Washington, Seattle.

Syms, E. Leigh
1969 *The McKean Complex as a Horizon Marker in Manitoba and on the Northern Great Plains.* Unpublished M.A. thesis, Department of Archaeology, University of Manitoba, Winnipeg.

1970 The McKean Complex in Manitoba. In, *Ten Thousand Years: Archaeology in Manitoba,* edited by Walter M. Hlady. Manitoba Archaeological Society, Altona, pp. 123-138.

1977 Cultural Ecology and Ecological Dynamics of the Ceramic Period in Southwestern Manitoba. *Plains Anthropologist* 22(76/2),*Memoir* 12.

Tamplin, Morgan
1977 *Prehistoric Occupation and Resource Exploitation on the Saskatchewan River at The Pas, Manitoba.* Unpublished Ph.D. dissertation, Department of Anthropology, University of Arizona, Tucson.

Tanner, A.
1979 Bringing Home Animals. *Social and Economic Studies* 23. Institute of Social and Economic Research, St. Johns.

Thomas, D.H.
1991 *Archaeology: Down to Earth.* Harcourt Brace Jovanovich College Publishers, Orlando.

Todd, Lawrence C. and David J. Rapson
1988 Long Bone Fragmentation and Interpretation of Faunal Assemblages: Approaches to Comparative Analysis. *Journal of Archaeological Science* 15(3): 307-325.

Towner, Ronald H. and Miranda Warburton
1990 Projectile Point Rejuvenation: A Technological Analysis. *Journal of Field Archaeology* 17: 311-321.

Tratebas, Alice M.
1985 McKean Settlement Patterns in the Black Hills: Suggestions for Future Research. In *McKean/Middle Plains Archaic: Current Research,* edited by Marcel Kornfeld and Lawrence C. Todd, pp. 137-146. Occasional Papers on Wyoming Archaeology No. 4, Laramie, Wyoming.

Tringham, Ruth, Glenn Cooper, George Odell, Barbara Voytek and Anne Whitman
1974 Experimentation in the Formation of Edge Damage: A New Approach to Lithic Analysis. *Journal of Field Archaeology* 1: 171-195.

Vance, Robert E.
1987 Meteorological Records of Historic Droughts as Climatic Analogues for the Holocene. In *Man and the Mid-Holocene Climatic Optimum,* Proceedings of the 17th Annual Chacmool Conference, edited by Neil A. McKinnon and G.S.L. Stuart, pp. 17-32. University of Calgary Archaeological Association, Calgary.

Vance, Robert E., D. Emerson and T. Habgood
1983 A Mid-Holocene Record of Vegetative Change in Central Alberta. *Canadian Journal of Earth Sciences* 20:364-376.

Vaughan, Patrick C.
1985 *Use-Wear Analysis of Flaked Stone Tools*. University of Arizona Press, Tucson.

Vehik, Susan C.
1977 Bone Fragments and Bone Grease Manufacturing: A Review of Their Archaeological Use and Potential. *Plains Anthropologist* 22(77): 169-182.

Verbicky-Todd, Eleanor
1984 Communal Buffalo Hunting Among the Plains Indians. Archaeological Survey of Alberta, *Occasional Paper*, No. 24. Alberta Culture, Edmonton.

Vickers, J. Roderick
1983 An Introduction to Alberta Radiocarbon Dates. In *Archaeology in Alberta 1982*, compiled by D. Burley, pp. 134-141. Archaeological Survey of Alberta Occasional Paper 21. Alberta Culture Historical Resource Division, Edmonton.

1986 *Alberta Plains Prehistory: A Review*. Archaeological Survey of Alberta Occasional Paper No. 27. Alberta Culture Historical Resource Division, Edmonton.

Vonhof, A.
1969 *Tertiary Gravels and Sands in the Canadian Great Plains*. Unpublished Ph.D. dissertation, Department of Geological Sciences, University of Saskatchewan, Saskatoon.

Wade, William D.
1981 Temporal and Biological Dimensions of the Gray Site Population. *Canadian Journal of Archaeology* 5: 119-130.

Wagner, G. A., M. J. Aitken and V. Mejdahl
1983 *Handbook for Archaeologists, No. 1: Thermoluminescence Dating*. European Science Foundation, Strasbourg.

Walde, Dale Allen
1985 *On Assigning Gender to Post-Cranial Bison Bones*. Unpublished Master's thesis, Department of Anthropology, Simon Fraser University, Victoria.

Walker, Ernest G.
1983 *Archaeological Resource Assessment: The Tipperary Creek Project. Investigation Permit No. 82-26*. Submitted to the Meewasin Valley Authority, Saskatoon. Copies available at the Meewasin Valley Authority, Saskatoon.

1984 The Graham Site: A McKean Cremation from Southern Saskatchewan. *Plains Anthropologist* 29 (104): 139-150.

1986 Appendix A: Human Skeletal Remains from the Crown Site. In *The Crown Site (FhNa-86) Excavation Results* by J. Michael Quigg, Nipawin Reservoir Heritage Study, Volume 8. Saskatchewan Research Council, Saskatoon.

1987 The Gowen Site: Cultural Adaptation on the Northern Plains During the Altithermal Period. In *Man and the Mid-Holocene Climatic Optimum*, Proceedings of the 17th Annual Chacmool Conference, edited by Neil A. McKinnon and G.S.L. Stuart, pp. 111-122. University of Calgary Archaeological Association, Calgary.

1992 *The Gowen Sites: Cultural Responses to Climatic Warming on the Northern Plains (7500-5000 B.P.)*. Archaeological Survey of Canada Mercury Series Paper 145. Canadian Museum of Civilization, Ottawa.

Walker, Ernest G., Richard E. Morlan and Leslie J. Amundson
1987 *Archaeological Field Investigations at the Wanuskewin Heritage Park 1986 Field Season Interim Report*. Submitted to Social Sciences and Humanities Research Council of Canada and Archaeological Resource Management Section, Saskatchewan Parks, Recreation and Culture, Permit Investigation Number 86-49.

Webb, Thompson III,
1986 Is Vegetation in Equilibrium with Climate? How to Interpret Late-Quaternary Pollen Data. *Vegetatio* 67: 75-91.

Webb, T. and R.A. Bryson
1972 Late and Postglacial Climatic Change in the Northern Midwest, U.S.A.: Quantitative Estimates Derived from Fossil Pollen Spectra by Multivariate Statistical Techniques. *Quaternary Research* 2:70-115.

Wendland, W. M.
1978 Holocene Man in North America: The Ecological Setting and Climatic Background. *Plains Anthropologist* 23(82): 273-287.

Wettlaufer, Boyd

1951 An Archaeological Survey of Saskatchewan No.1. *Archaeological Survey of Canada Unpublished Manuscript No. 83,* National Museum of Canada and Provincial Museum of Saskatchewan, Regina.

1955 *The Mortlach Site in the Besant Valley of Central Saskatchewan.* Anthropological Series No. 1. Department of Natural Resources, Regina.

Wettlaufer, Boyd and William J. Mayer-Oakes

1960 *The Long Creek Site*. Saskatchewan Museum of Natural History Anthropological Series No. 2. Department of Natural Resources, Regina.

Whallon, R.E. Jr

1973 Spatial Analysis of Paleolithic Occupation Areas: The Present Problem and "Functional Argument". In *The Explanation of Culture Change*, edited by C. Renfrew, pp. 115-129. Academic Press, New York.

Wheat, Joe Ben

1971 Lifeways of Early Man in North America. *Arctic Anthropology* 8: 22-31.

1979 The Jurgens Site. *Plains Anthropologist* 24(84), *Memoir* 15, pp 1-153.

Wheeler, Richard P.

1952 A Note on the "McKean Lanceolate Point." *Plains Anthropological Conference Newsletter* 4(4): 39-44.

1954 Two New Projectile Point Types: Duncan and Hanna Points. *Plains Anthropologist* 1: 7-14.

1985 The Middle Prehistoric Period in the Central and Northern Plains. In *McKean/Middle Plains Archaic: Current Research*, edited by Marcel Kornfeld and Lawrence C. Todd, pp. 5-10. Occasional Papers on Wyoming Archaeology No. 4. Wyoming Recreation Commission, Cheyenne.

White, E.M. and L.A. Hannus

1983 Chemical Weathering of Bone in Archaeological Soils. *American Antiquity* 48 (2): 316-322.

White, Theodore E.

1952 Observations on the Butchering Techniques of Some Aboriginal Peoples: 1. *American Antiquity* 17(4): 337-338.

1953 Observations on the Butchering Techniques of Some Aboriginal Peoples No. 2. *American Antiquity* 18(2): 160-164.

1954 Observations on the Butchering Techniques of Some Aboriginal Peoples Nos. 3, 4, 5 and 6. *American Antiquity* 19(3): 254-264.

Willey, Gordon R. and Philip Phillips
1958 *Method and Theory in American Archaeology*. University of Chicago Press, Chicago.

Williams, B.J.
1974 A Model of Band Society. *American Antiquity* , Memoir 29.

Wilson, Malcolm
1982 Appendix A: A Palynological Study of Core Samples from the Beds of Three Ponds in the Nipawin Heritage Study Area. In *Nipawin Reservoir Heritage Study* Volume 3, edited by David Burley and David Meyer, pp. 288-318 (SRC Publication No. C-805-25-E-82). Saskatchewan Research Council, Saskatoon.

Wilson, Michael
1978 Archaeological Kill Site Populations and the Holocene Evolutin of the Genus *Bison*. In *Bison Procurement and Utilization: A Symposium*, edited by Leslie B. Davis and Michael Wilson. *Plains Anthropologist Memoir* 14: 9-22.

Wood, W. Raymond
1980 Plains Trade in Prehistoric and Protohistoric Intertribal Relations. In, *Anthropology on the Great Plains* edited by W. Raymond Wood and Margot Liberty, pp. 98-109. University of Nebraska Press, Lincoln.

Wood, W. Raymond and Margot Liberty
1980 *Anthropology on the Great Plains*. University of Nebraska Press, Lincoln.

Wood, W. Raymond and D.L. Johnson
1982 A Survey of Disturbance Processes in Archaeological Site Formation. In *Advances in Archaeological Method and Theory: Selections for Students from Volumes 1 through 4*, edited by Michael B. Schiffer, pp. 539-607. Academic Press, New York.

Wormington, H.M. and Richard G. Forbis
1965 *An Introduction to the Archaeology of Alberta, Canada*. Denver Museum of Natural History Proceedings No. 11, Denver, Colorado.

Wright, J.V.
1972 *The Shield Archaic*. Publications in Archaeology 3. National Museum of Man, Ottawa.

Yellen, John E.
1977 *Archaeological Approaches to the Present: Models for Reconstructing the Past.* Academic Press, New York.

Zoltai, Stephen C.
1989 Macrofossil Studies, EgKx-1: Evaluation of Upland Botanical Remains from the Wanipigow Lake Beach (1976) and Cabin Point (1977) Site Areas. *Manitoba Archaeological Quarterly* 13 (1-4): 66-136.

Zoltai, Stephen C. and Dale H. Vitt
1990 Holocene Climatic Change and the Distribution of Peatlands in Western Interior Canada. *Quaternary Research* 33:231-240.

APPENDIX A

Redtail Site Faunal Data and Calculations

Table 1 Distal Metatarsal Data and Measurements

Cat. #	Unit	Layer	Side	Meas. D	Meas. E	Meas. F	Meas. I	Meas. J
633	121N 114E	8(1)	Right	5.75	2.88	2.65	3.64	3.45
712	124N 113E	9	Left	5.89	2.85	2.75	3.70	3.67
1439	122N 112E	13(1)	Left	6.11	2.88	2.74	3.85	3.51
1929	121N 111E	13(2)	Left	6.28	3.12	2.95	NA	NA
3909	123N 108E	12	Right	6.37	3.18	2.83	3.42	3.32
4260	121N 108E	13(2)	Right	NA	2.78	2.70	3.27	3.11
4294	124N 107E	10	Right	6.85	3.36	3.10	4.13	3.86

Refer to Speth (1983: 172-180) for measurement definitions.

Table 2 Distal Metatarsal Calculations Used to Determine Gender

Cat. #	Eq.1,Pt.1	Eq.1,Pt.2	Diff. Eq.1	Eq.2,Pt.1	Eq.2,Pt.2	Diff. Eq.2	Eq.3,Pt.1	Eq.3,Pt.2	Diff. Eq.3	Gender
633	293.9472182	298.063	-4.115779	354.66	358.35	-3.69	380.08	384.29	-4.20	Female
712	309.793866	312.0336	-2.239747	376.00	379.91	-3.92	400.50	404.52	-4.02	Female
1439	326.0617256	327.3794	-1.31768	389.36	388.80	0.56	426.59	424.98	1.61	Male(?)
1929	358.8142318	355.3905	3.4237473	NA	NA	NA	NA	NA	NA	Male
3909	359.319355	356.9486	2.3707209	339.93	339.46	0.46	388.94	389.38	-0.45	Male(?)
4260	NA	NA	NA	303.21	305.67	-2.46	NA	NA	NA	Female
4294	416.9050984	407.8938	9.0113274	464.77	455.75	9.02	510.60	501.24	9.36	Male

Refer to Walde (1985: 57-58) for equations.

Table 3 Proximal Metatarsal Data and Measurements

Cat. #	Unit	Layer	Side	Meas. A	Meas. B
712	124N 113E	9	Left	5.32	5.28
1439	122N 112E	13(1)	Left	5.31	4.9
4058	122N 108E	11	Left	5.23	5.27
4294	124N 107E	10	Right	6.09	5.22

Refer to Speth (1983: 172-180) for measurement definitions.

Table 4 Proximal Metatarsal Calculations used to Determine Gender

Cat. #	Eq.1,Pt.1	Eq.1,Pt.2	Diff. Eq.1	Gender
712	278.50	278.83	-0.33	Female (?)
1439	249.56	251.36	-1.81	Female (?)
4058	274.51	275.69	-1.18	Female (?)
4294	301.71	295.31	6.40	Male

Refer to Walde (1985: 57-58) for equations.

Table 5 Distal Metacarpal Data and Measurements

Cat. #	Unit	Layer	Side	Meas. D	Meas. E	Meas. F	Meas. J
84	125N 114E	13(3)	Right	6.40	3.08	2.86	3.44
441	122N 114E	8(2)	Right	7.70	3.90	3.72	3.74
666	121N 114E	13(1)	Right	7.47	3.87	3.73	3.94
4854	124N 105E	8(1)	Right	7.21	3.60	3.36	3.25

Refer to Speth (1983: 172-180) for measurement definitions.

Table 6 Distal Metacarpal Calculations Used to Determine Gender

Cat. #	Eq.1,Pt.1	Eq.1,Pt.2	Diff. Eq.1	Eq.2,Pt.1	Eq.2,Pt.2	Diff. Eq.2	Eq.3,Pt.1	Eq.3,Pt.2	Diff. Eq.3	Gender
84	331.49	338.07	-6.58	209.02	215.59	-6.57	340.38	346.95	-6.57	Female
441	448.68	437.01	11.66	337.01	324.73	12.29	450.60	439.38	11.22	Male
666	482.34	468.75	13.59	330.24	317.76	12.49	473.37	460.37	13.00	Male
4854	341.02	340.09	0.93	284.55	280.21	4.34	354.37	353.40	0.97	Male(?)

Refer to Walde (1985: 57-58) for equations.

Table 7 Proximal Metacarpal Data and Measurements

Cat. #	Unit	Layer	Side	Meas. A	Meas. B
441	122N 114E	8(2)	Right	7.97	3.86
3904	123N 108E	11	Left	6.57	3.61

Refer to Speth (1983: 172-180) for measurement definitions.

Table 8 Proximal Metacarpal Calculations Used to Determine Gender

Cat. #	Eq.1,Pt.1	Eq.1,Pt.2	Diff. Eq.1	Eq.2,Pt.1	Eq.2,Pt.2	Diff. Eq.2	Gender
441	322.46	316.01	6.45	334.94	323.76	11.18	Male
3904	234.71	240.48	-5.77	224.88	228.42	-3.53	Female

Refer to Walde (1985: 57-58) for equations.

Table 9 Distal Tibia Data and Measurements

Cat. #	Unit	Layer	Side	Meas. H	Meas. I	Meas.J
280	123N 114E	9	Right	8.53	5.93	5.83
424	123N 114E	14(3)	Left	6.9	5.12	5.15
3919	123N 108E	11	Left	6.89	5.38	4.88

Refer to Speth (1983: 172-180) for measurement definitions.

Table 10 Distal Tibia Calculations Used to Determine Gender

Cat. #	Eq.1,Pt.1	Eq.1,Pt.2	Diff. Eq.1	Eq.2,Pt.1	Eq.2,Pt.2	Diff. Eq.2	Gender
280	638.86	618.82	20.04	476.49	460.79	15.70	Male
424	470.26	469.97	0.30	324.95	327.44	-2.49	Female
3919	436.28	439.47	-3.19	336.02	337.84	-1.82	Female

Refer to Walde (1985: 57-58) for equations.

Table 11 Proximal Radius Data and Measurements

Cat. #	Unit	Layer	Side	Meas. A	Meas. B	Meas. C	Meas. D
444	122N 114E	8(2)	Right	10.3	5.29	2.6	4.26
1250	124N 112E	13(4)	Right	10.6	NA	NA	5.33
1675	124N 111E	13(2)	Right	8.78	4.8	2.93	3.62
2579	122N 110E	13(1)	Right	4.58	4.46	2.7	4.92
4946	121N 104E	13	Right	9.17	NA	NA	4.2

Refer to Speth (1983: 172-180) for measurement definitions.

Table 12 Proximal Radius Calculations Used to Determine Gender

Cat #	Eq.1,Pt.1	Eq.1,Pt.2	Diff. Eq.1	Eq.2,Pt.1	Eq.2,Pt.2	Diff. Eq.2	Eq.3,Pt.1	Eq.3,Pt.2	Diff. Eq.3
444	339.93	353.42	-13.48	367.66	373.39	-5.72	306.64	307.80	-1.16
1675	272.84	289.17	-16.32	298.82	305.16	-6.34	225.01	238.91	-13.90
2579	300.93	314.50	-13.57	178.31	197.39	-19.08	232.14	250.56	-18.42

Cat. #	Eq.4,Pt.1	Eq.4,Pt2	Diff.Eq.4	Eq.5,Pt.1	Eq.5,Pt.2	Diff.Eq.5	Eq.6,Pt.1	Eq.6,Pt.2	Diff.Eq.6	Gender
444	241.12	251.43	-10.31	323.25	330.99	-7.74	318.77	310.32	8.45	Female(?)
1675	210.52	217.99	-7.47	285.93	292.05	-6.12	247.20	250.19	-2.98	Female
2579	46.30	70.45	-24.15	238.44	252.12	-13.69	125.72	150.00	-24.28	Female

Refer to Walde (1985: 57-58) for equations.

Table 13 Bison Carpal Measurements in mm

Bone Type/Side	Cat. #	Layer	Length/La	Width/Lp	Depth
Radial/Right	447	8(2)	32.0	35.0	53.2
Radial/Right	967	13(2)	31.0	34.0	53.0
Radial/Left	3903	11	33.0	30.0	45.5
Internal/Right	950	13(2)	31.3	33.6	43.7
Internal/Left	3902	11	29.4	33.9	41.7
Ulnar/Right	442	8(2)	36.7	46.0	47.0
Ulnar/Right	974	13(2)	35.8	44.0	41.0
Ulnar/Right	1309	12	39.0	45.4	45.0
Ulnar/Left	3906	11	34.0	40.4	38.0
Accessory/Right	949	13(2)	NA	23.9	35.3
Accessory/Left	2296	13(1)	NA	23.5	39.6
Fused 2&3/Right	1052	8(1)	NA	53.2	41.9
Fused 2&3/Left	3908	11	NA	40.8	31.7

Measurements after Morlan (1991)

Table 14 Bison Tarsal Measurements in mm

Bone Type/Side	Cat. #	Layer	Length	Width	Depth
Unciform/	3899	11	28.0	33.0	31.0
Fused C&4/Left	968	13(2)	46.0	63+	60+
Fused C&4/Right	3236	12	NA	60.0	59+
Fused C&4/Left	3934	11	49.0	58.0	60.0
Fused C&4/Right	4297	11	46.0	70.0	66.0
Fused C&4/Right	4648	9	55.0	71.0	67.0
Lat.Malleo/Right	809	9	32.5	NA	42.7
Lat.Malleo/Left	1481	8(1)	35.5	NA	45.4
Lat.Malleo/Left	2185	13(2)	24.8	NA	33.7
Lat.Malleo/Right	2692	15(1)	27.4	NA	34.9
Lat.Malleo/Left	4068	11	27.0	NA	34.5
Lat.Malleo/Right	4675	12	28.8	NA	40.3
Fused 2&3/Right	2670	15(1)	NA	24.9	38.1
Fused 2&3/Right	3798	11	NA	28.2	44.0
Fused 2&3/Left	4047	10	NA	27.0	38.6
Fused 2&3/Right	4276	9	NA	30.3	45.5

Measurements after Morlan (1991) Note: + indicates poor measure

Table 15 Bison Astragulus Measurements

Cat. #	Side	Layer	Comment	Lm	Ll	Wd	Wp	Dm	Dl
425	Left			71	75	50	52	40	41
626	Left		immature	57.1	58.9	38	38	31	32
688	Left			69.7	74.6	50	52	41	41
937	Left			72	76	49	52	43	42
1475	Right		weathered	NA	NA	NA	48	NA	NA
3801	Right			77	82	60	58	47	46
3847	Left		weathered	68	NA	NA	50	NA	NA
4009	Right		weathered	69	72	47	46	38+	38+
4067	Left			73	76	51	50	43	42+
1473	Left			73+	76	52	55	45	43+

Note: + indicates poor measurements.

Table 16 Bison Calcaneus Measurements

Cat. #	Side	Layer	Comment	Lt	Lc	Wd	Wp	Dp	Dd
1478	Right		Near cmplt	32	36	47	36	37	NA
3780	Right			37	43	58	44	51	65
3795	Right			36	46	59	45	45	65
4026	Left			30	38	47	37	38	53
4041	Left			33	40	49	36	42	60

Table 17 Bison Skull Measurements, from unit 123N 109E, L. 10

Measurement #	Measure (mm)
8	27.5
9	30.0
10	46.0
12	18.5
30	18.9
31	32.0
32	29.0
33	35.0
34	29.0
42	69.3
42a	85.5
43	69.3
46	7.9
47	26.5

Note: that measurement locations are presented in Appendix A, Figure 1 (from von den Dreisch 1976: 29).

Table 18 Measurements of Various Bison Bones

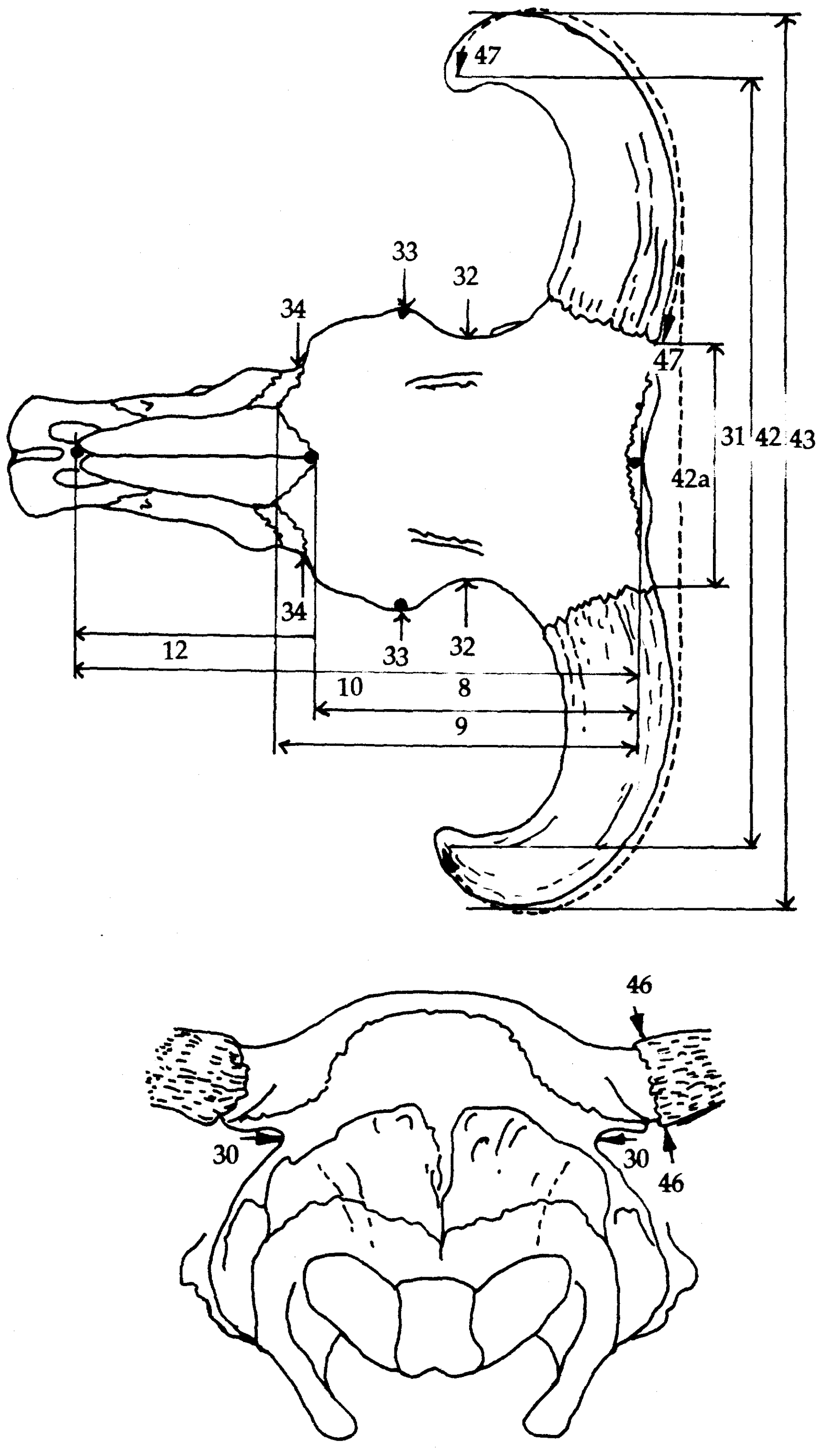
Bone Type	Side	Cat. #	Layer	GB	GL	BFcr	BFcd	GLF	H	LCDe	LAPa	BPacd	SBV	LA	SH	SB	BG	SLC	GLP	LG
Atlas Vert.	NA	3918	11	216+	128+	121	123	112+	114	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Atlas Vert.	NA	3653	10	NA	94	125	NA	NA	97+	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Axis Vert.	NA	1757	13(1)	NA	NA	113	57	NA	NA	102	94+	80	70	NA	NA	NA	NA	NA	NA	NA
Acetabulum	Right	4407	8(1)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	93+	53	32	NA	NA	NA	NA
Acetabulum	Right	1347	14(1)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	72+	NA	NA	NA	NA	NA	NA
Scap.Prox.	Right	1614	12	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	58	77	NA	NA
Scap.Prox.	Left	1351	14(3)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	51+	NA	NA	NA
Scap.Prox.	Right	3343	10	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	58	73	94	76

Measurements from Von den Dreisch (1976: 67-83).

Table 19 Measurements of Various Canid Bones

Bone Type	Side	Cat. #	Layer	GL	GLC	Dp	SD	Bp	DPA	BPC	SLC	GLP	BG	LG	L	W
Humerus	Right	1979	11	193+	185+	51.3	14.3	NA	NA	NA	NA	NA	NA	NA	NA	NA
Scapula	Right	3932	10	NA	NA	NA	NA	NA	NA	NA	31.4	37.9	23.1	32.7	NA	NA
Radius	Right	3186	10	NA	NA	NA	15.7	22.6	NA	NA	NA	NA	NA	NA	NA	NA
Ulna	Right	3167	10	NA	NA	NA	NA	NA	30.6	19.5	NA	NA	NA	NA	NA	NA
Radius	Left	961	13(2)	NA	NA	NA	11.8	18.3	NA	NA	NA	NA	NA	NA	NA	NA
Ulna	Left	975	13(2)	NA	NA	NA	NA	NA	NA	15.2	NA	NA	NA	NA	NA	NA
Lower P4	Right	301	12	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	16.5	6.9
Upper M2	Right	302	12	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	24.4	6.8
Lower P4	Right	3996	13(2)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	15.0	6.1
Lower P4	Left	4010	12	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	15.1	5.9

Measurements from Von den Dreisch (1976: 42-81).



From von den Dreisch (1976: 29).

Figure 1 Bison Skull Measurement Locations, for Appendix A, Table 17

APPENDIX B

McKean Comparative Site Data

Table 1 McKean Component Comparative Framework

1. Chipped Lithic Tools:	
(note presence and number of each)	
Projectile points:	McKean Lanceolate
	Duncan
	Hanna, concave base
	Hanna, convex/straight base
	Mallory
	Oxbow
	Pelican Lake, straight base/narrow neck
	Pelican Lake, convex base/broad neck
	Side-notched (generic)
	Side-notched (Mummy Cave series)/other
Bifaces:	Large hafted/pointed bifaces
	Ovate preforms/others
Unifaces:	Endscraper, flat cross-section
	Endscraper, convex-straight cross-section
	spokeshaves, hafted
	spokeshaves
	Hafted and pointed unifaces/flake points/others
Marginal Retouch Tools:	gravers/tipped
	notched tools/others
Cores:	split cobble
	split pebble
	bifacial
	unifacial
	others
2. Large/Granular Lithic Tools:	
(note presence and number of each)	
Hammers:	pecked
	grooved
Anvils:	pecked
Abraders:	smoothed/ground surface
	grooved
Choppers:	straight edge
	convex edge
	concave edge
	used cores
	others
3. Bone/Antler Tools:	
	Awls
	Flintknapping tools
	Antler cores
	Other modified bone/antler

Table 1 McKean Component Comparative Framework (contd.)

4. General Material Aspects:	
Shell:	Beads
	Shaped Pendants
	Other
Ochre:	Chunks/pieces
	Paint stains
Fire-Broken Rock:	Weight per area unit per occupation (note area excavated)
Lithic Tools:	Note local/nonlocal materials & weight per unit/occupation
(note area	Nonlocal materials to locale (total weight)
of excavation)	(e.g. > about 30 km radius of site/component)
	Nonlocal materials to region (total weight)
	(e.g. > about 200 km radius of site/component)
Other unique items:	
5. Faunal Aspects:	
Bone:	Total weight all bone
(note area	Total weight of Burned bone
of excavation)	Fragmentation of Bone
	(as indicated by average weight of bone)
Butchering batter marks/cut marks present	
	on Bison, deer, antelope and other ungulates
	on Canids
	on Other
Ungulate bone	
representation:	Bone bed or articulated skeletal units noted
	Skull remains present(excluding mandible & hyoid)
	Vertebrae or ribs present
	Pelvii or scapulae present
	Limbs (upper) present
	(e.g. humerus, femur, tibia, radius and ulna)
	Limbs (lower) present
	(e.g. metapodials, carpals, tarsals, phalanges and sesmoids)
Fauna represented:	Ungulates (e.g.Bison, Deer, Moose, Elk and Antelope)
	Canids (e.g.Wolf, Coyote, Mid-sized, Fox)
	Mustelid (e.g.Mink, Skunk, Wolverine, Badger)
	Lagomorph (e.g.Jackrabbit, Cottontail)
	Rodents (e.g.Beaver, Muskrat, Porcupine, Squirrel)
	Micro-rodents (e.g.Shrew, least chipmunk, vole)
	Birds (e.g.Corvid, Raptor, Water-fowl)
	Other
	Seasonalities suggested
6. Features/Patterns:	
Hearths:	Surface
	Basin shaped
	Rock-lined
	Other

Table 1 McKean Component Comparative Framework (contd.)

Pits:	Squarish
	Basin-shaped
	Rock-lined
	Bone-filled / other
Burials:	(Extended, flexed, incomplete, burned, sex, age, etc.)
	Associations (ochre stains, copper, stone, antler, etc.)
	Within habitation area / outside
Structural Indicators:	tipi (stone circle)
	post holes
	debris accumulation outlines (in or out)
	pithouse (depression)
	midden areas
Flotation data:	charcoal (types present)
	seeds (types present)
	other
	seasonality suggested
7. Location/Environmental Aspects:	
Location potential use:	
	trap / ambush potential
	look-out / vantage point
	topographic wind / weather shelter (e.g. valley / rockshelter)
	other
Water nearness & type:	
(note distance)	river (name)
	creek / spring (name)
	lake (name)
	slough
Geomorphic location:	river terrace (note confluence, upper / lower terrace, name)
	sandhills
	open prairie / plains
	rockshelter
	hilltop / butte top
	other
Ecodistrict: (present, but note transition locations)	(Mixed-grass Prairie, Parkland, Mixed-wood, Shortgrass Prairie, Parkland / Mixed-wood Transition, Riparian and Sandhill complexes)
8. Temporal Aspects:	
Chronometric Dates:	Radiocarbon (note material dated, layer, associations)
	Other (note method and comparisons with radiocarbon and strata)
Relative Dates:	Multi-component Associations (e.g. Oxbow, Pelican Lake, Mummy Cave above / below)
	Mixed component associations (e.g. Oxbow, Pelican Lake, Mummy Cave above / below)
	Location (e.g. upper terrace)
Excavation Method:	Natural / Arbitrary excavation layers / levels
	Point provenience data / quadrant / meter unit provenience

Table 2 Cactus Flower Site Comparative Data

Occupation	III	IV	V	VI	VII	VIII	IX	X
1. Chipped Lithic Tools:								
McK.Lanc.Point type		1				2	1	
Duncan	1	1	1	1	2	5		
Hanna	2	2		3		2		
Lg.Hafted Bifaces					3	1		
Pointed bifaces		1		1	1	6		
Ovate/Rect Bif.		2		2	2	3	4	
Irreg. Bifaces		1				1	3	
Endscrapers,Triang.		1	1	3	1	5	5	
Endscrapers,Paral.		2	2		2	3		
Endscrapers.Ovate				2				
spokeshave, hafted		1				2		
spokeshave		1						
Flake points								
gravers/tipped tools					1	1	1	
notched tools		1						
split pebble cores*		5	1	5	6	35	8	
Red. Qtzt cobble cores $		5	1	10		5		1
Bifacial cores~		1	1	1	2	15	1	
2. Large/Granular Tools:								
Hammers						2	5	1
Anvils				1		2		
Other: stone disc				1				
Other: stone pipe						1		
3. Bone/Antler Tools:								
Awls		4	1	4		3		
Polished & Blunted				3	1	5	3	
Bone beads		1				2		
Antler tip/tine/frg.			1	2				
Antler billet								
Other		1	1	2	1	4		
4. General Material Aspects:								
Shell beads		1					1	
Shell disk				1				
Red Burnt Shale		X		X			X	
Stone &FBR (gm/m2)	164	359	54	534	365	1253	216	458
Flakes/Deb. (gm/m2)	6	96	16	216	29	225	101	37
Bone (gm/m2)	23	32	47	136	68	531	69	17
Burned Bone	NA	NA	NA	NA	NA	NA	NA	NA
Total Excav. Area(m2)	181	219	229	230	234	131	130	97

Table 2 Cactus Flower Comparative Data (contd.)

Occupation	III	IV	V	VI	VII	VIII	IX	X
5. Faunal Aspects:								
Bison bison (MNI)	1	2	1	4	3	20	6	1
Proghorn (MNI)		1		3		1	1	
Mule Deer (MNI)				1				
Canid Domes. (MNI)		1		1		3		
Swift fox (MNI)						1		
Cottontail (MNI)					1	1	1	
Jackrabbit (MNI)						1		
Birds			2(v. small passerine & small raptor)		1 (indt)	1 (icterid: common grackle)		common grackle)
Fish						1		
Mollusk		1		1	1(burnt)		1	
Seasonality(ies)	?	Fall/Wi (1 Bis. Mand.)	?	?	Sp/Su/F (2 Bis. Mand.)	Fall/Wi (10 Bis. Mands.) Su/Fall (Bird)	Fall/Wi (1 Bis. Mand.)	?
6. Features/Patterns:								
surface hearth	5	3	1	2	3			1
basin hearth	1	3		3	4	4	1	
rock-lined hearth/pit	0							1
oval/circ-shaped pit	4				1	1		
irreg. pit	3							
ash conc.					5			
Circular Debris Pattern								
Poss. Struct.(diam. m)				1 (3.1m)		1 (4.8m)		
7. Location/Enviro. Aspects:								
Camp location with potential ambush area a few hundred m to north along river.								
12 to 30 m from present S. Saskatchewan River edge (site's bank is eroding, so originally excav. part of camp was further from the river)								
Geomorphic location: on a river oxbow peninsula/flat, upper 6 m of 15 m high bank								
Ecodistrict: riparian complex/shortgrass prairie								
8. Temporal Aspects:								
Chronometric:/rcy B.P. range		3525 to 3755		3520 to 4050		4045 to 4350		
material dated		cha+bon		cha+bon		cha		
number of dates	1(rej)	2		2		2	1(rej)	1(rej)
Relative dates:	Pelican Lake narrow neck/straight base in Occupation I (3 ppts)							
Layer depths in profile:	1.9m	2.55m	2.75m	2.85m	4.35m	5.4m	5.6m	5.7m

* Split pebble cores are equivalent to Brumley's (1975) pieces esquilles.

$ Reduced quartzite cobble cores are equivalent to Brumley's (1975) subgroup 5 and 6 of Heavy Chipped Stone Tools, Plate 27 c and Plate 29 g.

~ Bifacial cores are equated with Brumley's (1975) crude bifaces.

Table 3 Crown Site Comparative Data

Occupation(s)	"Bottom"	McKean Component	"Sterile" Occup.	Hanna Component
1. Chipped Lithic Tools:		(2-3 occup's)		(3-4 occ)
McKean Lanc.Point		7		
Duncan Pt.				2
Hanna Pt.(Convex Base)				2
Hanna Pt.(Strt Base)				5
Oxbow Pt.				1
Mummy Cave Pt.				1
Lg. Haft Bif.		2		7
Pointed Bif.		5		
Ovate/Tri Bif.		2		4
Irreg. Bif.		5		
Crude Bif.Pref				
Endscraper,Tri		4		6
Endscraper,Para		1		3
Endscraper,Ovate		1		4
Endscraper,Irreg		6		5
Sidescraper		2		
spokeshave,hafted				2?
spokeshave				
Flake points				2
Blade-like uniface				2
gravers,tip tools		2?		
notched tools				2?
Split pebble cores		1		
Bipolar cores		12		11
Single platform		15		16
Multiple platforms		15		6
2. Large Granular Tools:				
Hammers		8		3+2 used cores
Anvils		4/8 hammers combo		1 used core
Other:				
3. Bone/Antler Tools:				
Awls				
Polished/Blunted		3		3
Bone Beads				
Antler tip/tine/frg.		1		
Antler Billet				
Other:Elk Antler Base				1 (cut)
4. General Material Aspects:				
Shell Beads				
Shell disk				
Red Ochre				
FBR (gm/m2)	0	40.6	0	1714.1
Debitage (gm/m2)	2.9	172.3	10.5	241.9
Bone (gm/m2)	2.7	78.1	13.2	337.2
Burn Bone (gm/m2)	0	16.7	0.4	67.4
Total Excav.Area(m2)	15	70	33	70

Table 3 Crown Site Comparative Data (continued)

Occupation(s)	"Bottom"	McKean Component	"Sterile" Occup.	Hanna Component
5. Faunal Aspects:				
Bison bison (MNI)	1	3	1	3+
Elk (MNI)		2		2
Moose (MNI)		2		3
Deer (MNI)				1
Canid (wolf) (MNI)				
Canid (Dog) (MNI)		3	1	2
Canid (Coyo) (MNI)				
Bear/Black (MNI)				1
Cottontail (MNI)				
Rabbit (MNI)	1	3	1	1
Beaver (MNI)		2		3
Skunk (MNI)		2		
Bird (MNI)		1 (grouse)+1?		1?
Fish (NISP)	1	145	1	12
Mollusk (NISP)		30		26
Dentalium (NISP)		1		
Seasonality(ies)	?	Mid Winter/ Early Spring	Late Winter/ Early Spring	Late Spring/ Early Sum for 2 occup
6. Features/Patterns:				
surface hearth		3		
basin hearth				
rock conc. hearth/pit				2
oval/circ pit				
irreg. pit				
ash conc.				
charc. conc.				
Bone pile		1		
Burial				1
Circular Debris Patrn.				
Poss. Struct. (diam m)				
7. Location/Enviro. Aspects:				
Camp location: confluence of Saskatchewan River and a creek on vistigial terrace base of slope				
Geomorphic location: river/tributary terrace, northeast facing slope, south side of river				
Ecodistrict: riparian complex/in present mixed-wood forest but palynological and botanical evidence suggests that it was in the Parkland Ecodistrict during these occupations				
8. Temporal Aspects:				
Chronometric:rcy B.P.	4685 to	3735 to	3870 to	3320 to
range	4865	4445	4060	3725
material dated	carbon soil	Bone	carbon soil	bone
number of dates	1	6	1?	3
Relative dates:				
Layer depths in profile:	1.25-1.3 m	3L:E block=.9-1.2m 2L:W block=.5-.7m	E block only .6-.7m	4L:E block=.2-.6m 4L:W block=.2-.45m

Table 4 Redtail Site Comparative Data

Occupation(s)	L8	L9	L10	L11	L12	L13(1)	L13(2)	L13(3)	L13(4)	L14	L15
1. Chipped Lithic Tools:											
McK.Lanc.Pt.							1		2		
Duncan? Pt					1						
Hanna Pt.(indt)				1							
Hanna Pt (Strt)					1						
Hanna(cncv)					1						
Oxbow Pt											
Side/Notch Pt					3						
Lg Haft Bif					1	1					
Lg Pointed Bif					1		1	1			
Ovate Bif				1							
Irreg Bif											
Crude Bif											
Endscrap.Tri											
Sidescrap.Para			1								
Endscrap.Ovat											
Endscrap.Irreg							1				
spokshv.haft											
spokshv.											
flake pt.					2						
blade-like unif											
graver/tip tool			1	1	1		2				
notched tool			1								
split pebble cor			1		1	2		2		1	
unif core					3	3			2		
bifac. core		1			5	2	5				
cobble					5	1		1	1		
split cobble					1						
utiliz core					1						
bipolar core	1				1	2	1				
amorphous core		1		1	3	1				1	
2. Large Granular Tools:											
Hammers	2				4				2		
Anvils	2			1	2						
Choppers					1				1		
Smooth surf				1			1				
V.Lg.Bif/corsmat					1						
Groove abrader						1					
3. Bone Tools:											
Polish/Round				2	2		1				
Shaped piece											
4. General Material Aspects:											
Red Ochre (gm)	0	0	19.6	0	75.8	59.2	262.9	0	1.8	92.2	0
FBR (gm/m2)	20.9	13.6	84.4	305.1	1744.2	248.5	395.8	121.6	72.6	177.6	0
Deb (gm/m2)	1.1	1	1.8	9.2	38.3	12.4	11	1.5	1.3	0.9	2
Bone (gm/m2)	206.5	27.7	214.4	497.1	313.9	135.3	286.7	23.2	77.3	141.9	205.1
Bur.Bo(gm/m2)	8.9	0.1	2.8	15.4	23.4	21.1	56.4	5.2	1.1	8.9	0.4
Total Excv.(m2)	43	37	41	44	44	43	39	42	38	31	4

Table 4 Redtail Site Comparative Data (continued)

Occupation(s)	L8	L9	L10	L11	L12	L13(1)	L13(2)	L13(3)	L13(4)	L14	L15
5. Faunal Aspects:											
Bison (MNI)	2m:3im	1m	2m	1m:1im	2m:1im	2m:1im	1m:1im	1m	1m:1im	1m:1im	1m
Deer (MNI)	1m	1im								1m	
Proghorn (MNI)	1m										
Wolf (MNI)			1m	1m	1m:1im						1m
MidCanid(MNI)				1m		1im	1?				
Coyote (MNI)								1m			1m
Red Fox (MNI)			1m		1m						
Cottontail(MNI)							1				
Jackrabbit(MNI)	1				1		1			1	
Mink (MNI)							1				
Skunk(MNI)				1im							
Bird(MNI)	2(crow+					1 robin			2(crow+		
Fish (MNI)	hawk)								duck)		2
Mollusk (NISP)					3						
Seasonality(ies)	sp/su	?	?	sp/su	fa/wi	su	?	?	sp/su	sp+?	?
(tenuous)	fa/wi										
6. Features/Patterns:											
Surface Hearth	5		1	7	6	2	2	1	3		
Basin Hearth	2			2			1				
Rock con. H/Pit					1						
Oval/circ pit											
Irreg. Pit	1					1					
Squarish pit	1										
pithouse	1										
Ash conc.	3										
Char. Conc.	13			8	8	2	2				
Bison Skull			1								
Circular Debris	feat conc			1 (feat+	1 (feat+						
Pos.Struct(diam)	3.7m+			mat) 3m	mat) 3m						

7. Location/Enviro. Aspects:

Camp Location: confluence of S. Saskatchewan River and small spring run-off basin, terrace/base slope.
Geomorphic location: river/tributary alluvial/colluvial terrace, southeast facing slope, west bank of river
Ecodistrict: riparian complex/in present mixed-grass prairie/parkland transition ecotone, assumed mixed-grass prairie at time of these occupations.

8. Temporal Aspects:

Occupation(s)	L8	L9	L10	L11	L12	L13(1)	L13(2)	L13(3)	L13(4)	L14	L15
Chronometric:				3400 to	3390 to		3790 to		4200 to		4920 to
rcy B.P. 1s range				3560	3735		3950		4360		5100
materil dated				bone	bone		bone		bone		bone
# dates				1	2		2		1		1
Relative dates:				Hanna	Hanna		McKean		McKean		
Layer depth/m	.4 -.6	.67-.74	1.00-1.07	1.10-1.12	1.14-1.16	1.18-1.23	1.27-1.3	1.3-1.34	1.4-1.45	1.5-1.6	1.7-2.2

Table 5 Other Saskatchewan Site's Projectile Point Metric and Nonmetric Data (Continued)

Cat. #	Site Borden	Provenience	Point type	Material type	Max. Lnth	Max. Wd.	Max.Wd dis.fmBs	Max. Thick	Bod. Lth.L	Bod. Lth.R	N/S Ht.L	N/S Ht.R	N/S Dp.L	N/S Dp.R	Shld Wd	Max BsWd	Neck Wd	Base ConDp	Bs Nch Wd.out	Bs Nch Wd.In	Edg <L	Edg <R	Wt (gm)
Sullivan Site (EjNr-1), fragmented points (continued):																							
44	EjNr-1	Bag #44	D	SilWood	NA	21.7	NA	6.2	NA	NA	NA	NA	NA	NA	21.7	NA	16.6	NA	NA	NA	39	39	7.1
44	EjNr-1	Bag #44	D	SRC	NA	16.8	NA	7.2	NA	NA	10.5	12.7	NA	NA	16.8	15.4	15.4	NA	NA	NA	66	62	2.7
44	EjNr-1	Bag #44	H/D	Chert	NA	19.2	NA	7.0	24.5	23.2	NA	NA	2.4	2.9	19.2	NA	12.6	NA	NA	NA	55	44	4.3
44	EjNr-1	Bag #44	D/M	SRC	NA	17.5	NA	6.7	NA	NA	NA	NA	NA	NA	17.5	NA	15.0	NA	NA	NA	46	42	3.0
44	EjNr-1	Bag #44	D/H	SilPt(Ht)	NA	16.4	NA	5.7	18.0	17.5	NA	NA	NA	NA	16.4	NA	13.2	NA	NA	NA	61	64	2.1
37	EjNr-1	Bag #44	D/H	SRC	NA	20.9	NA	7.3	NA	NA	NA	NA	2.6	1.5	20.0	NA	16.3	NA	NA	NA	44	53	6.6
10	EjNr-1	T.P. #3	SN	SRC	NA	16.4	11.0	6.8	NA	NA	11.0	NA	1.6	NA	16.4	NA	13.8	NA	NA	NA	55	62	3.5
8	EjNr-1	T.P. #3	D/H	SRC	NA	21.1	NA	6.3	22.5	23.2	NA	NA	NA	NA	21.1	NA	18.2	NA	NA	NA	47	37	4.0
Big Kill Site (EbNj-2):																							
1	EbNj-2	1008/12869	M	FslChrt	NA	23.8	20.2	6.5	NA	NA	18.6	15.7	1.3	0.8	23.8	23.1	22.6	7.0	13.3	6.2	40	38	6.7
2	EbNj-2	1008/12869	M	KRFpat	47.3	19.8	20.6	10.0	32.2	34.5	14.7	10.8	1.0	1.1	19.6	17.8	16.5	5.6	9.5	5.0	37	29	4.8
3	EbNj-2	1008/12869	M	KRFpat	33.2	19.9	12.9	4.0	21.5	NA	10.2	11.6	0.7	NA	33.2	14.6	14.3	5.2	7.2	3.9	36	34	2.2
4+4a	EbNj-2	1008/12869	M	KRF	57.2	22.1	28.3	10.4	NA	NA	NA	NA	NA	NA	22.1	19.0	19.0	4.7	8.7	4.4	31	35	7.0
5	EbNj-2	1008/12869	M	FusShl	NA	20.2	14.7	5.2	NA	NA	NA	NA	NA	NA	NA	20.2	18.0	9.7	11.4	5.2	43	33	2.5
6	EbNj-2	1008/12869	M	SilPt(Ht)	31.0	17.9	10.0	5.3	NA	NA	12.1	9.7	NA	NA	17.9	16.4	16.4	5.4	7.3	4.5	56	55	2.9
7	EbNj-2	1008/12869	M	KRF	NA	15.9	11.5	10.5	NA	NA	13.1	15.1	NA	NA	15.9	15.1	15.1	6.3	9.2	5.3	42	41	2.5
Billett Site (EkNv-36):																							
714	EkNv-36	30-34N/10E	PL	SilPt	NA	17.5	6.7	3.8	NA	NA	4.7	5.4	2.5	3.2	17.5	9.0	7.7	NA	NA	NA	56	55	1.1
711	EkNv-36	30-34N/10E	H?	SilPt	NA	16.3	8.5	4.5	NA	NA	8.0	8.2	4.0	3.1	16.3	11.5	9.3	NA	NA	NA	32	34	1.6
724	EkNv-36	surf.NE cor.	D?	SRC	NA	15.3	10.2	4.7	NA	NA	12.3	7.9	1.0	1.7	15.4	13.7	13.3	4.0	11.1	5.7	48	38	1.7
517	EkNv-36	10-15N/1E	H?	SltStn	NA	16.7	12.2	4.1	NA	NA	11.0	12.5	1.3	1.7	16.6	13.9	12.0	1.0	7.9	5.3	40	34	0.8
572	EkNv-36	10-14N/1-2E	H	Quartz	30.0	18.2	11.0	7.6	21.1	20.9	10.0	11.8	2.3	1.7	18.2	16.1	13.7	1.5	7.5	4.8	75	60	3.8
Graham Site (FaNq-30):																							
23A	FaNq-30	NA	D	GreySRC	28.4	15.6	12.8	6.5	19.0	17.4	8.6	8.5	0.8	1.2	15.7	14.5	13.3	2.0	8.4	5.7	51	54	2.7
Bag 23	FaNq-30	NA	LgSN	GreySRC	77.3	37.0	27.8	11.6	53.5	53.8	18.3	14.4	3.7	3.8	37.0	30.9	25.6	NA	NA	NA	45	49	31.3

Table 5 Other Saskatchewan Site's Projectile Point Metric and Nonmetric Data

Cat. #	Site Borden	Provenience	Point type	Material type	Max. Lnth	Max. Wd.	Max.Wd dis.fmBs	Max. Thick	Bod. Lth.L	Bod. Lth.R	N/S Ht.L	N/S Ht.R	N/S Dp.L	N/S Dp.R	Shld Wd	Max BsWd	Neck Wd	Base ConDp	Bs Nch Wd.out	Bs Nch Wd.In	Edg <L	Edg <R	Wt (gm)
Broken Axle Site (FhNc-81):																							
422	FhNc-81	54S 46E, L.3	H??	SRC	NA	20.2	12.1	7.5	NA	NA	10.7	NA	3.0	NA	20.2	NA	12.0	Slcnvx	NA	NA	45	50	4.5
2001	FhNc-81	54S 47E, L.9	stem?	SRC	NA	18.4	1.6	5.6	NA	NA	NA	NA	NA	NA	NA	18.4	13.9	Slcnvx	NA	NA	29	34	1.1
2517	FhNc-81	56S 47E, L.7	H?	SRC	NA	17.8	11.1	7.0	NA	NA	10.9	9.5	2.8	2.2	17.8	14.7	11.5	Slcncv	NA	NA	49	56	3.5
5447	FhNc-81	47S 49E, L.9	PL	SRC	25.0	16.9	9.1	5.3	19.5	17.6	7.3	6.6	3.4	2.8	16.9	11.5	8.6	Strt	NA	NA	35	40	1.9
6556	FhNc-81	52S 49E, L.6	PL	Chert	NA	17.7	NA	3.3	19.2	18.2	NA	NA	NA	NA	17.7	NA	NA	NA	NA	NA	37	25	0.1
8463	FhNc-81	51S 50E, L.7	H??	GSltSt	NA	18.5+	13.3	6.7	NA	NA	9.7	NA	3.0	NA	18.5+	13.7	11.3	Strt	NA	NA	48	44	3.0
Sullivan Site (EjNr-1), NonMcKean points:																							
46	EjNr-1	Bag #45	O	SilPt	NA	NA	NA	5.1	NA	NA	5.0	NA	1.9	NA	NA	NA	NA	5.7	NA	NA	39	NA	2.0
45	EjNr-1	Bag #45	O	FusShl	NA	NA	NA	6.2	NA	NA	NA	7.0	NA	2.8	NA	NA	NA	NA	NA	NA	NA	37	2.2
45	EjNr-1	Bag #45	O	FusShl	NA	23.5	3.0	5.2	NA	NA	7.2	6.6	2.0	2.0	21.5	23.5	18.7	3.5	15.0	6.4	54	54	1.6
NA	EjNr-1	Bag #45	PL	KRF	NA	NA	NA	4.3	NA	NA	NA	NA	4.2	NA	NA	NA	NA	NA	NA	NA	NA	40	1.9
NA	EjNr-1	Bag #45	O?	SilPt (Ht)	NA	22.8	NA	5.5	NA	NA	NA	NA	NA	NA	21.7	NA	18.5	NA	NA	NA	41	38	4.0
11	EjNr-1	T.P. #3	O	Yel.Jspr	NA	NA	NA	4.0	NA	NA	NA	5.4	NA	2.2	NA	NA	NA	4.3	NA	NA	NA	36	0.9
Sullivan Site (EjNr-1), fragmented points:																							
15	EjNr-1	T.P. #3/*	H?	SRC	NA	17.5	NA	5.6	16.0	16.5	NA	NA	1.5	1.3	17.5	NA	15.3	NA	NA	NA	34	36	2.2
1/4 arb	EjNr-1	Bag #43	H?	SilPt(Ht)	NA	NA	NA	6.9	NA	NA	NA	12.5	NA	1.5	NA	16.8	15.4	2.2	7.1	4.2	32	47	3.5
30	EjNr-1	Bag #44	H	FusShl	NA	NA	NA	7.5	NA	NA	12.4	NA	2.0	NA	NA	NA	13.2	3.1	8.8	5.8	48	59	2.7
26	EjNr-1	Bag #44	D	SRC	NA	20.9	17.7	6.3	NA	NA	14.3	18.4	2.5	2.0	20.9	17.1	16.3	2.2	8.1	4.8	36	49	4.4
NA	EjNr-1	Bag #44	D?	SRC	NA	18.6	17.0	6.6	NA	NA	12.5	17.1	3.4	1.1	18.6	NA	13.4	1.6	NA	NA	47	35	3.2
NA	EjNr-1	Bag #44	D?	SRC	NA	18.2	19.0	11.3	NA	NA	NA	NA	NA	NA	18.2	15.1	14.5	1.6	NA	NA	42	54	1.8
NA	EjNr-1	NA	SN?	SRC	NA	NA	NA	6.7	NA	NA	NA	NA	NA	NA	NA	17.0	14.9	1.4	NA	NA	58	58	1.5
NA	EjNr-1	NA	H/SN	SRC	NA	19.3	15.2	7.2	NA	NA	NA	11.2	2.9	2.1	19.1	NA	13.9	1.8	NA	NA	39	51	3.1
NA	EjNr-1	NA	D?	SRC	NA	20.0	19.2	6.5	NA	NA	14.3	14.0	2.7	1.8	19.6	NA	14.6	2.9	NA	NA	39	40	3.0
NA	EjNr-1	NA	M/D	SilPt(Ht)	NA	18.2	7.1	4.2	NA	NA	NA	NA	NA	NA	NA	17.7	NA	2.3	7.5	4.5	45	46	0.8
NA	EjNr-1	NA	H/D	SilPt	NA	19.2	2.0	5.2	NA	NA	NA	NA	NA	NA	NA	19.2	NA	2.2	7.8	6.0	57	64	0.6
NA	EjNr-1	NA	H	SRC	NA	18.2	12.3	5.8	NA	NA	NA	NA	NA	NA	NA	16.7	15.0	1.8	6.3	4.3	52	51	1.6
NA	EjNr-1	NA	D	Qurtzt	NA	NA	NA	6.0	NA	NA	NA	NA	NA	NA	NA	16.4	16.1	1.7	8.4	5.7	53	38	1.7
NA	EjNr-1	NA	D?	SRC	31.6	19.0	15.9	7.2	19.9	25.4	8.2	5.9	1.4	.8	18.4	15.1	14.9	1.0	10.8	NA	42	57	4.1
45	EjNr-1	Bag #45	H/D	SRC	NA	17.7	NA	6.1	NA	NA	NA	NA	NA	NA	17.7	15.9	14.3	1.9	9.0	5.6	58	41	1.8
45	EjNr-1	Bag #45	H	SilPt	NA	18.2	NA	7.2	NA	NA	NA	NA	NA	NA	18.2	18.1	15.3	2.6	9.3	6.5	44	47	2.1
45	EjNr-1	Bag #45	D	SilPt	NA	17.3	NA	6.0	NA	NA	NA	NA	NA	NA	17.3	17.0	16.3	1.6	5.6	3.9	46	55	1.6
44	EjNr-1	Bag #44	D	SRC	NA	20.3	NA	7.4	NA	NA	NA	NA	NA	NA	20.3	NA	15.3	NA	NA	NA	42	43	6.2

Table 6 Saskatchewan Study Area McKean Associated Radiocarbon Dates

Site Name	Borden Site No.	Occup. Layer /Depth	Lab. Sample No.	Sample Matrix	Cult. Mat. Assoc.	C-14 rcy B.P.	One Sigma Error	# Cal. Inter-cepts	Cal. yrs B.P. 2 Sigma Minimum	Cal. yrs B.P. 2 Sigma Maximum	Date Assess. (CLR)
Billett	EkNv-36	NA	S-2063	Char	H	3465	115	3	3469	4081	Good
Billett	EkNv-36	NA	S-2054	Char	HP?	3100	135	1	2949	3629	Fair
Cact.Flow.	EbOp-16	III	S-1209	Char	HD	3740	100	3	3830	4420	Poor
Cact.Flow.	EbOp-16	IV	S-822	Char	HDM	3620	95	5	3689	4229	V.Good
Cact.Flow.	EbOp-16	IV	S-784	Bone	HDM	3675	80	9	3829	4259	V.Good
Cact.Flow.	EbOp-16	VI	S-823	Char	HD	3615	95	3	3689	4229	Fair
Cact.Flow.	EbOp-16	VI	S-890	Bone	HD	3890	160	3	3869	4832	Fair
Cact.Flow.	EbOp-16	VIII	S-782	Char	DMH	4130	85	8	4419	4869	V.Good
Cact.Flow.	EbOp-16	VIII	S-1210	Char	DMH	4220	130	3	4420	5247	V.Good
Crown	FhNa-86	90-95	S-2526	Bone	M	3995	80	3	4249	4818	V.Good
Crown	FhNa-86	65 cm	S-2525	Bone	M	4295	85	1	4576	5210	V.Good
Crown	FhNa-86	52 cm	S-2524	Bone	M	3610	105	2	3644	4239	Good
Crown	FhNa-86	108-110	S-2521	Bone	M	3825	75	1	3989	4501	V.Good
Crown	FhNa-86	122 cm	S-2520	Bone	M	4330	115	1	4567	5299	V.Good
Crown	FhNa-86	23 cm	S-2556	Bone	HD	3605	120	1	3629	4279	Good
Crown	FhNa-86	35-40	S-2292	Bone	HD	3330	110	1	3359	3849	V.Good
Crown	FhNa-86	50-60	S-2554	Bone	HD	3600	80	1	3699	4145	V.Good
Crown	FhNa-86	50-60	S-2291	Bone	HD	3425	105	1	3459	3979	V.Good
Crown	FhNa-86	61 cm	S-2290	Bone	M	4180	115	5	4419	4989	V.Good
Crown	FhNa-86	100-105	S-2369	Bone	M	3825	90	1	3979	4516	V.Good

Table 6 Saskatchewan Study Area McKean Associated Radiocarbon Dates (Continued)

Site Name	Borden Site No.	Occup. Layer /Depth	Lab. Sample No.	Sample Matrix	Cult. Mat. Assoc.	C-14 rcy B.P.	One Sigma Error	# Cal. Inter-cepts	Calibrated 2 Sigma Minimum	Calibrated 2 Sigma Maximum	Date Assess.
Graham	FaNq-30	NA	S-1574	Bo.Hu	D	3245	50	1	3369	3619	Good
Long Creek	DgMr-1	L5	S-63a	Char	H	3370	115	5	3365	3961	Good
Mortlach	EcNl-1	L7	S-2	Bone	D	3400	200	3	3209	4228	Fair
Redtail	FbNp-10	L11	S-3372	Bone	H	3480	80	5	3569	3979	V.Good
Redtail	FbNp-10	L12(1)	S-3373	Bone	H	3470	80	3	3559	3977	V.Good
Redtail	FbNp-10	L12(2)	S-3008	Bone	H	3660	75	1	3777	4229	V.Good
Redtail	FbNp-10	L13(2)	S-3374	Bone	MD	3860	70	1	4089	4514	V.Good
Redtail	FbNp-10	L13(2)	S-3375	Bone	MD	3880	70	3	4091	4522	V.Good
Redtail	FbNp-10	L13(4)	S-3009	Bone	M	4280	80	1	4574	5043	V.Good
Sjovold	EiNs-4	L21	S-2062	Bone	H	3530	115	1	3491	4144	V.Good
Sjovold	EiNs-4	L21	S-91770	Bone	H	4130	205	8	4089	5289	V.Poor

References: Billett (Dyck 1983), Cactus Flower (Brumley 1975; Rutherford et al.1981, in Beaudoin 1987), Crown(Quigg 1986), Graham(Walker 1984), Long Creek (Wettlaufer and Mayer-Oakes 1960), Mortlach(Wettlaufer 1955), Sjovold (Ian Dyck, personal communication December 13,1990).

Note: M=McKean Lanceolate, D=Duncan, H=Hanna and P=Pelican Lake type point associations. Additionally, these point types are in order of most frequent to least frequent.

Table 7 Some Representative Spatially and Temporally Sorted McKean Associated Radiocarbon Dates

Site Name	Site # / Location	Occup. /Depth	Lab. #	Sample Matrix	Point Assoc(s)	C-14 rcy BP	One Sig.Err	# Cal. Intcpt	Cal. yrs B.P. 2 Sig. Min.	Cal. yrs B.P. 2 Sig. Mx.	References For Dates
Boreal Forest Prairie Provinces:											
The Pas Reserve	FlMh-2	5	A-1369	Char	DH	3190	60	3	3271	3627	Tamplin 1977
Grnd. Cache Lk.	FlQs-30	L3	S-1888	Char	M	4605	75	1	4997	5564	Beaudoin 1987
Parklands/Mixed Wood Forest, Saskatchewan:											
Crown	FhNa-86	35-40	S-2292	Bone	HD	3330	110	1	3359	3849	Quigg 1986
Crown	FhNa-86	50-60	S-2291	Bone	HD	3425	105	1	3459	3979	Quigg 1986
Crown	FhNa-86	50-60	S-2554	Bone	HD	3600	80	1	3699	4145	Quigg 1986
Crown	FhNa-86	23 cm	S-2556	Bone	HD	3605	120	1	3629	4279	Quigg 1986
Crown	FhNa-86	52 cm	S-2524	Bone	M	3610	105	2	3644	4239	Quigg 1986
Crown	FhNa-86	108-110	S-2521	Bone	M	3825	75	1	3989	4501	Quigg 1986
Crown	FhNa-86	100-105	S-2369	Bone	M	3825	90	1	3979	4516	Quigg 1986
Crown	FhNa-86	90-95	S-2526	Bone	M	3995	80	3	4249	4818	Quigg 1986
Crown	FhNa-86	61 cm	S-2290	Bone	M	4180	115	5	4419	4989	Quigg 1986
Crown	FhNa-86	65 cm	S-2525	Bone	M	4295	85	1	4576	5210	Quigg 1986
Crown	FhNa-86	122 cm	S-2520	Bone	M	4330	115	1	4567	5299	Quigg 1986
Mixed-Grass Prairie, South Central Saskatchewan:											
Billett	EkNv-36	NA	S-2054	Char	HP?	3100	135	1	2949	3629	Dyck 1983
Graham	FaNq-30	NA	S-1574	Bo.Hu	D	3245	50	1	3369	3619	Walker 1984
Mortlach	EcNl-1	L7	S-2	Bone	D	3400	200	3	3209	4228	Wettlaufer 1955
Billett	EkNv-36	NA	S-2063	Char	H	3465	115	3	3469	4081	Dyck 1983
Redtail	FbNp-10	L12(1)	S-3373	Bone	H	3470	80	3	3559	3977	Presented Here
Redtail	FbNp-10	L11	S-3372	Bone	H	3480	80	5	3569	3979	Presented Here
Sjovold	EiNs-4	L21	S-2062	Bone	H	3530	115	1	3491	4144	Dyck,Pers.Comm. 1990
Redtail	FbNp-10	L12(2)	S-3008	Bone	H	3660	75	1	3777	4229	Presented Here
Redtail	FbNp-10	L13(2)	S-3374	Bone	MD	3860	70	1	4089	4514	Presented Here
Redtail	FbNp-10	L13(2)	S-3375	Bone	MD	3880	70	3	4091	4522	Presented Here
Sjovold	EiNs-4	L21	S-91770	Bone	H	4130	205	8	4089	5289	Dyck,Pers.Comm. 1990
Redtail	FbNp-10	L13(4)	S-3009	Bone	M	4280	80	1	4574	5043	Presented Here

Table 7 Some Representative Spatially and Temporally Sorted McKean Associated Radiocarbon Dates (Continued)

Site Name	Site # / Location	Occup. / Depth	Lab. #	Sample Matrix	Point Assoc(s)	C-14 rcy BP	One Sig.Err	# Cal. Intcpt	Cal. yrs B.P. 2 Sig. Min.	Cal. yrs B.P. 2 Sig. Mx.	References For Dates
Southern Alberta:											
Cact.Flow.	EbOp-16	VI	S-823	Char	HD	3615	95	3	3689	4229	Brumley 1975
Cact.Flow.	EbOp-16	IV	S-822	Char	HDM	3620	95	5	3689	4229	Brumley 1975
Cact.Flow.	EbOp-16	IV	S-784	Bone	HDM	3675	80	9	3829	4259	Brumley 1975
Cact.Flow.	EbOp-16	III	S-1209	Char	HD	3740	100	3	3830	4420	Beaudoin 1987
Cact.Flow.	EbOp-16	VI	S-890	Bone	HD	3890	160	3	3869	4832	Brumley 1975
None	DjPn-16	NA	AECV-219C	Bone	M	3960	140	1	3991	4839	Beaudoin 1987
Cact.Flow.	EbOp-16	VIII	S-782	Char	DMH	4130	85	8	4419	4869	Brumley 1975
Cact.Flow.	EbOp-16	VIII	S-1210	Char	DMH	4220	130	3	4420	5247	Beaudoin 1987
Southeastern Saskatchewan/Northwest North Dakota:											
Long Creek	DgMr-1	L5	S-63a	Char	H	3370	115	5	3365	3961	Dyck 1983
Mondrian Tree	NW ND	NA	NA	NA	M Series	4030	110	3	4229	4849	Frison 1991
Little Missouri/Grand River:											
Lightning Spring	39HN204	8	Tx-4084	Char	DH?	3430	270	1	3009	4429	Keyser1985
Red Fox	32BO213	L4(1-4)	NA	Char	DH?	3770	90	3	3899	4419	Syms 1969
Lightning Spring	39HN204	10	Tx-4081	Char	D	3850	150	1	3839	4816	Keyser1985
Lightning Spring	39HN204	10	Tx-4082	Char	D	3870	210	5	3699	4859	Keyser1985
Lightning Spring	39HN204	9	Tx-4083	Char	DH?	4190	110	5	4429	4989	Keyser1985
Rosebud Creek/Tongue River Area, Montana:											
None	24RB1164	NA	Beta-35225	Bone	D?	3310	90	1	3369	3824	Munson 1990
Crook, Campbell Counties and Black Hills Area:											
Cordero Mine	48CA75	NA	RL-805	Char	M Series	3520	160	3	3410	4287	Frison 1991
Kolterman	39FA68	NA	M-368	NA	M Series	3630	350	3	3080	4869	Wheeler 1985
McKean	48CK7	LocI,Pithouse	RL-1860	Char	M Series	3790	140	3	3778	4549	Kornfeld & Frison 1990
George Hey	39FA302	NA	NA	NA	M Series	3925	65	1	4155	4539	Frison 1991
Gant	39ME9	Thin Deposit	NA	Char	MDHOMea	4130	130	8	4302	4981	Gant and Hurt 1965
Kolterman	39FA68	NA	M-369	NA	M Series	4230	350	3	3839	5722	Wheeler 1985
Hawken II	48CK303	NA	RL-470	Bone	M Series	4250	140	1	4429	5279	Frison 1991

Table 7 Some Representative Spatially and Temporally Sorted McKean Associated Radiocarbon Dates (Continued)

Site Name	Site #/ Location	Occup. /Depth	Lab. #	Sample Matrix	Point Assoc(s)	C-14 rcy BP	One Sig.Err	# Cal. Intcpt	Cal. yrs B.P. 2 Sig. Min.	Cal. yrs B.P. 2 Sig. Mx.	References For Dates
McKean	48CK7	LocII,Strata V	RL-1861	Char	MDH	4590	160	1	4859	5649	Kornfeld & Frison 1990
Yellowstone River HeadWaters:											
Rigler Bluffs	24PA401	about 8' DBS	W-1135	NA	1 StemPtFrg	4900	300	1	4859	6299	Syms 1969
Rigler Bluffs	24PA401	about 8' DBS	Grey No. 29	NA	1 StemPtFrg	5040	150	3	5467	5859	Syms 1969
Bighorn Basin Area:											
Grey-Taylor	48JO303	L2	A-483	Char	MiddlePeriod	3450	40	1	3629	3836	Craigie 1985; Syms 1969
Dead Indian	48PA551	NA	RL-321	Char	M Series	3800	110	3	3889	4522	Frison & Walker 1985
BottleNeck	48BH206	Good Strata	SI-239	Char	MDH	3820	200	1	3689	4835	Craigie 1985; Syms 1969
SouthSiderCave	48BH363	12'15"DBS	RL-668	Char	M Series	3900	140	1	3928	4824	Craigie 1985; Frison 1991
Grey-Taylor	48JO303	L2	A-485	Char	MiddlePeriod	3980	70	3	4259	4810	Craigie 1985; Syms 1969
Med.Ldge.Creek	48BH499	NA	RL-98	Char	M Series	3980	160	3	3989	4869	Craigie 1985; Frison 1991
Med.Ldge.Creek	48BH499	NA	RL-438	Char	M Series	4050	150	1	4093	4962	Craigie 1985; Frison 1991
SouthsiderCave	48BH363	NA	RL-672	Char	M Series	4170	150	5	4302	5239	Craigie 1985; Frison 1991
Leigh Cave	48WA304	NA	Grey 25	Char	HD	4180	160	5	4289	5257	Craigie 1985; Frison 1991
Dead Indian	48PA551	NA	W-2597	Char	M Series	4180	250	5	3991	5448	Craigie 1985; Frison 1991
Paint Rock V	48BH349	NA	RL-482	Char	M Series	4310	140	1	4458	5309	Craigie 1985; Frison 1991
Mummy Cave I	48PA201	L30	I-1428	Char	M Series	4420	150	1	4575	5459	Craigie 1985; Frison 1991
Dead Indian	48PA551	NA	W-2599	Char	M Series	4430	250	3	4409	5722	Craigie 1985; Frison 1991
Granite Creek	48BH330	NA	RL-389	Char	M Series	4700	130	3	4993	5728	Craigie 1985; Frison 1991
Sorenson	24CB202	NA	I-691	NA	M Series	4900	250	1	4898	6270	Frison 1991
Platte River Systems:											
Dipper Gap	5GL101	NA	UGa-456	NA	MiddlePeriod	3180	80	1	3218	3619	Frison 1991
Dipper Gap	5GL101	NA	UGa-453	NA	MiddlePeriod	3410	90	3	3469	3899	Frison 1991
Dipper Gap	5GL101	NA	UGa-455	NA	MiddlePeriod	3520	85	1	3619	4080	Frison 1991
Signal Butte IC	NW Neb	NA	L-385D	Char	HMMal?	4170	250	5	3988	5445	Syms 1969
Scoggin	48CR304	1	RL-174	Char	Mal.M	4540	110	3	4869	5565	Lobdell 1974
Signal Butte IA	NW Neb	NA	L-385B	Char	MHMal	4550	220	1	4571	5729	Syms 1969

Note: M=McKean Lanc., D=Duncan, H=Hanna, O=Oxbow, Mal=Mallory, Mea=Meade and McKean Series.

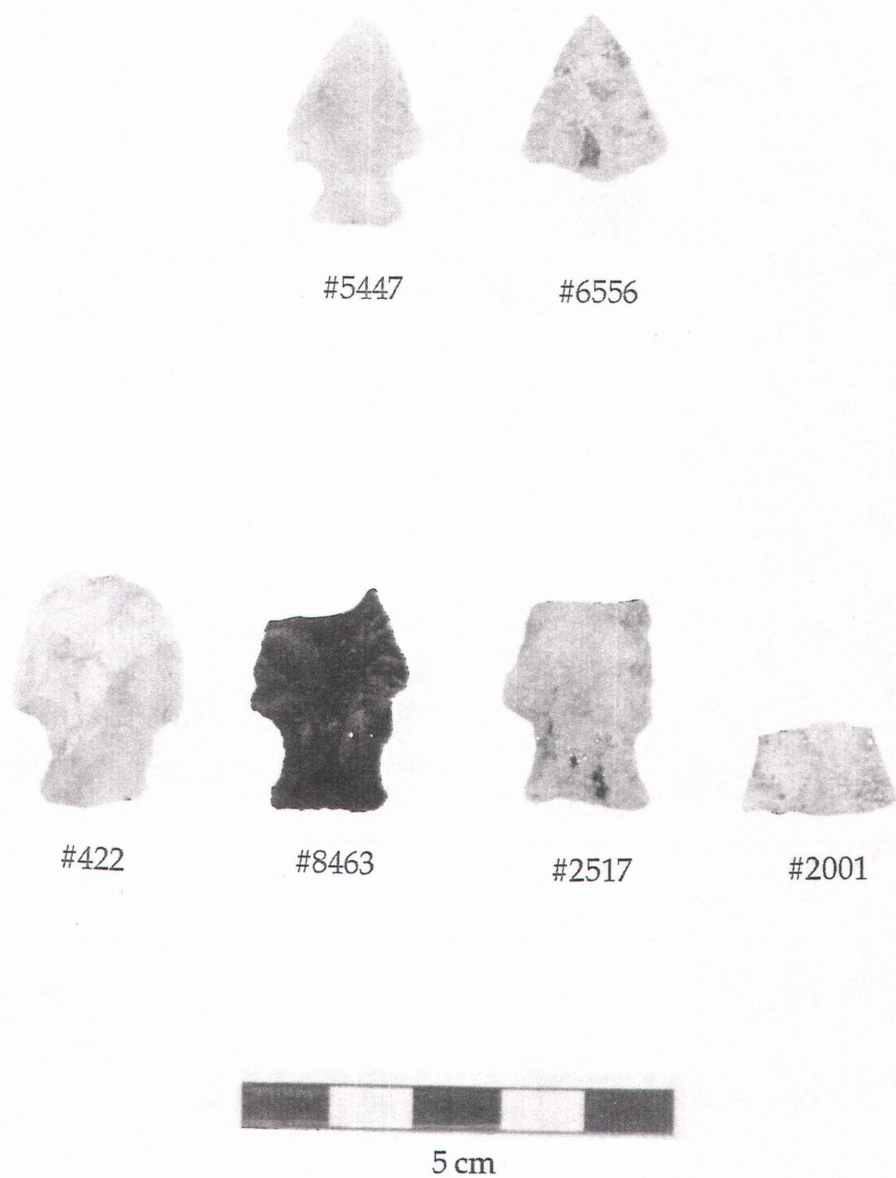
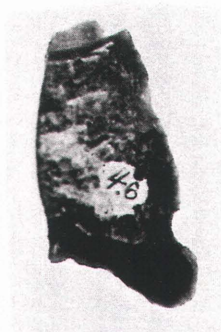
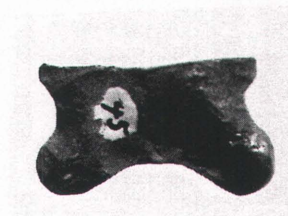


Figure 1 Photos of Points from the Broken Axle site

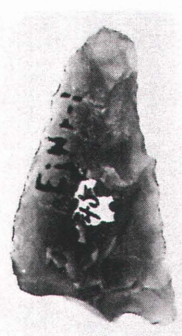


a
Area 46

b
Area 45



c
Area 45

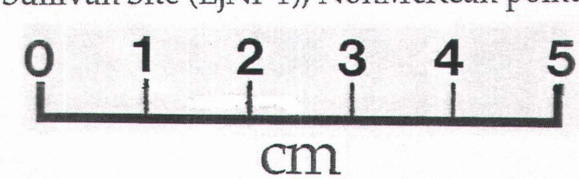


d

e

f
#11,T.P.3

Sullivan Site (EjNr-1), NonMcKean points:



Note: The points in this Figure are presented in sequence so as to correspond to the Sullivan site's point metrics and nonmetrics in Table 5.

Figure 2 Photos of Points from the Sullivan site

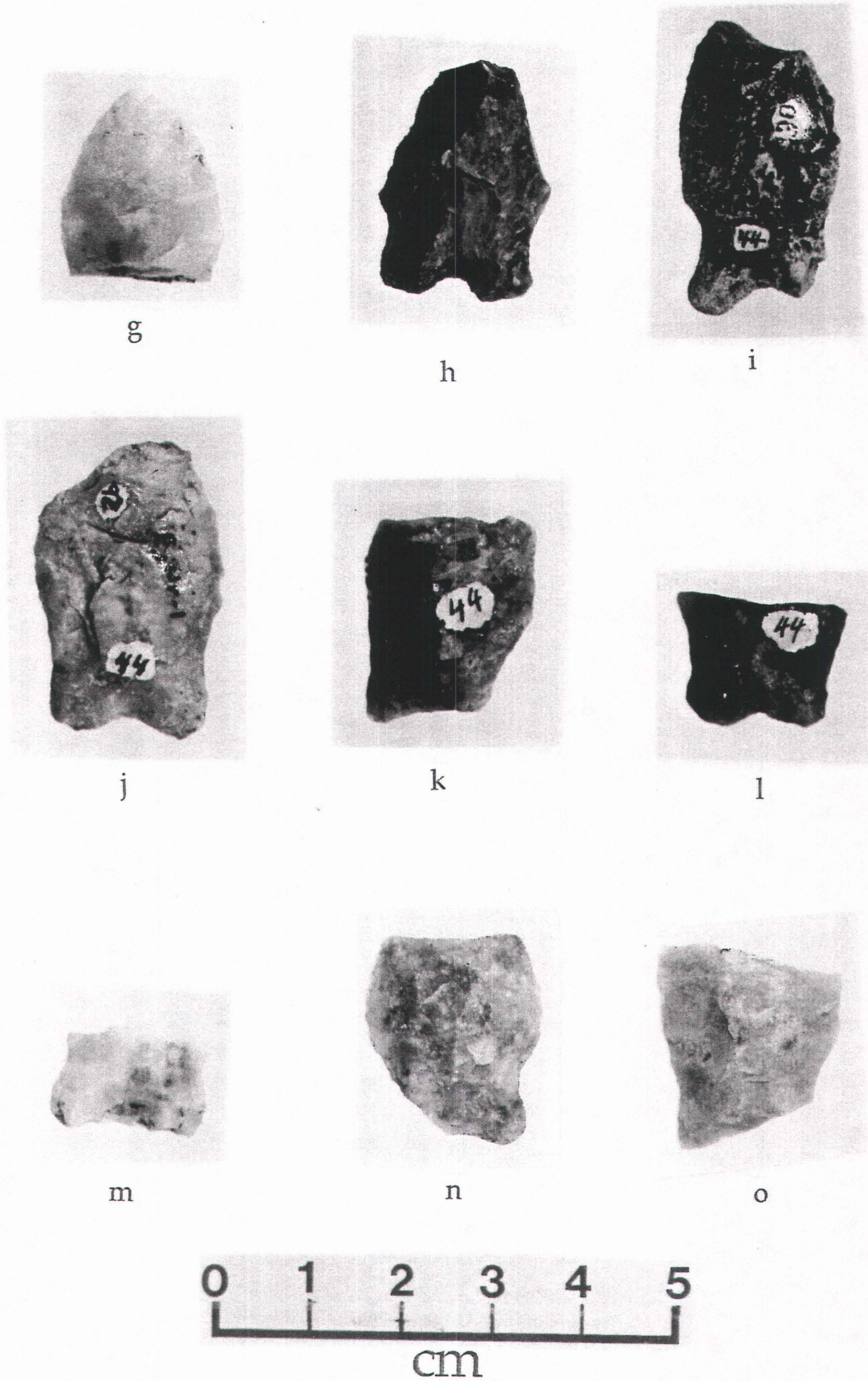


Figure 2 Photos of Points from the Sullivan site (Continued)

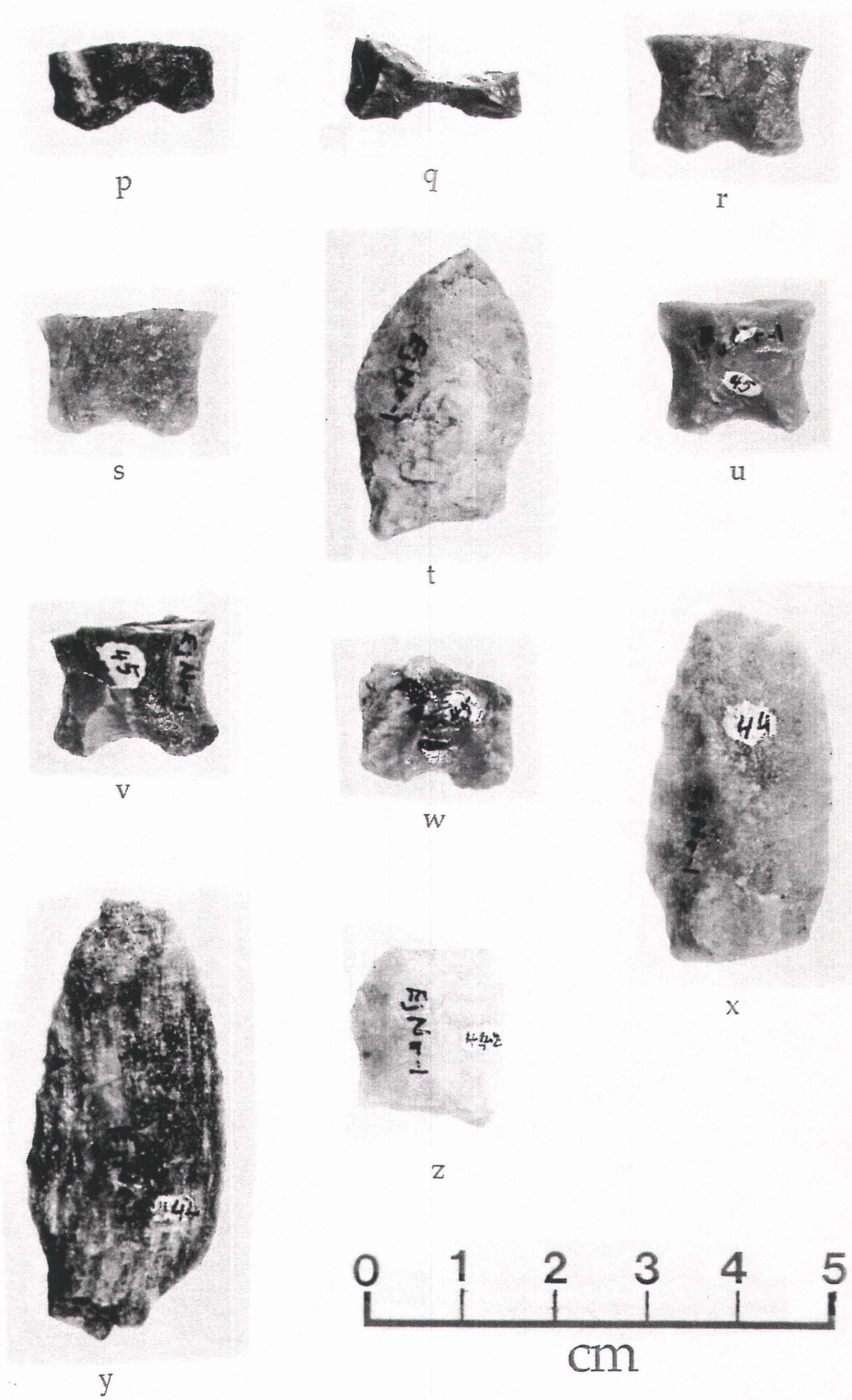


Figure 2 Photos of Points from the Sullivan site (Continued)

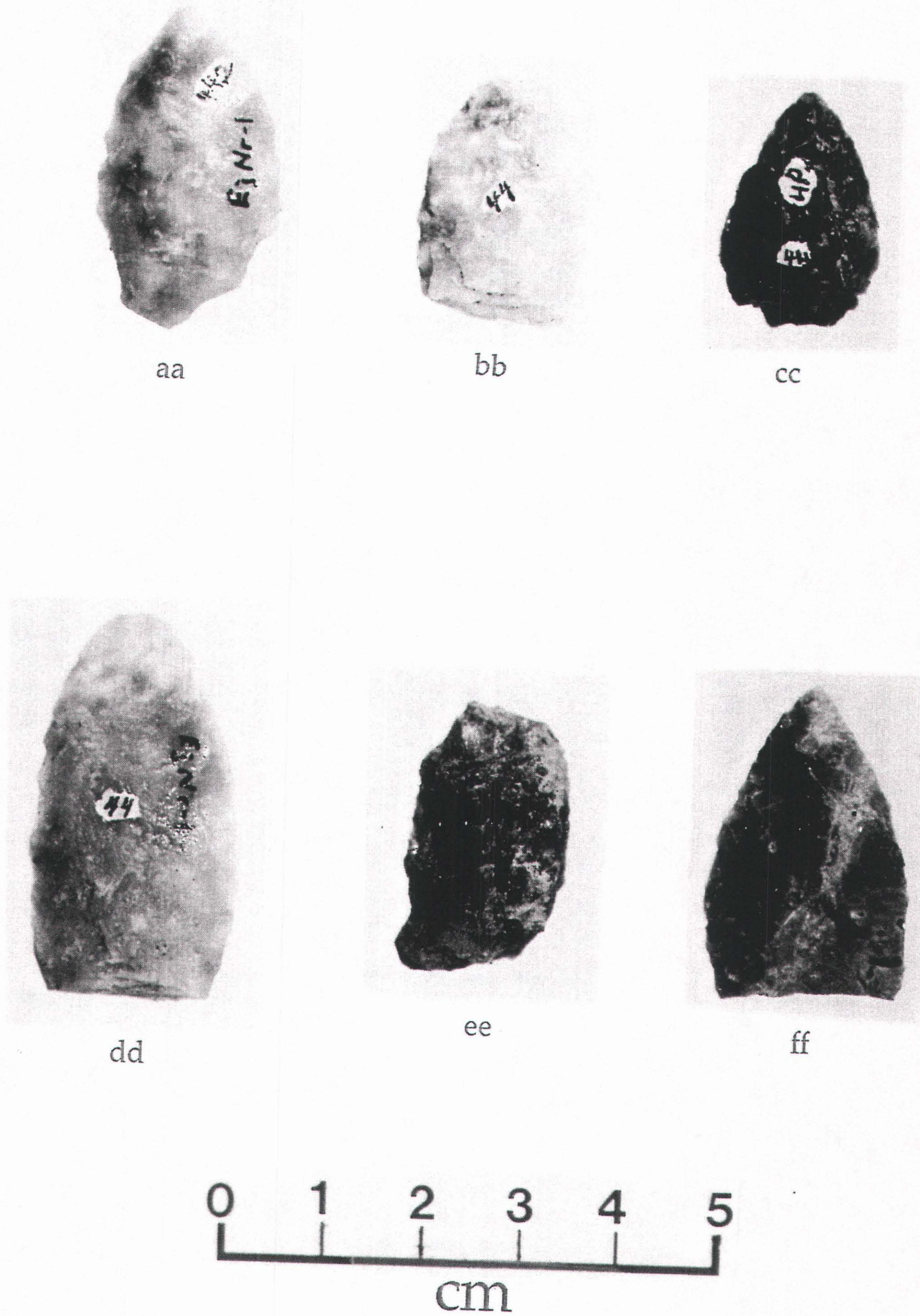


Figure 2 Photos of Points from the Sullivan site (Continued)

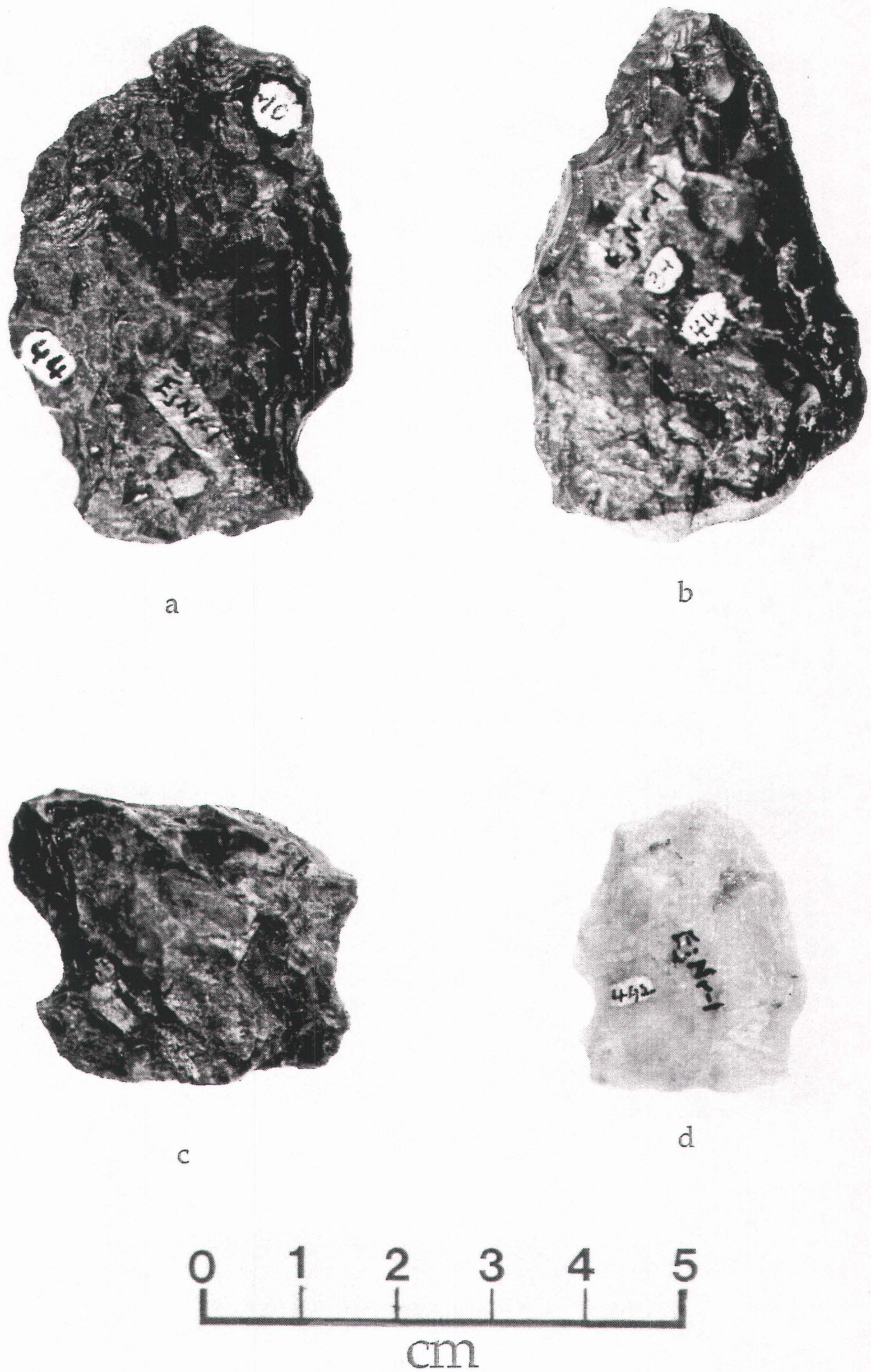


Figure 3 Photos of Large Pointed and/or Hafted Bifaces from the Sullivan site

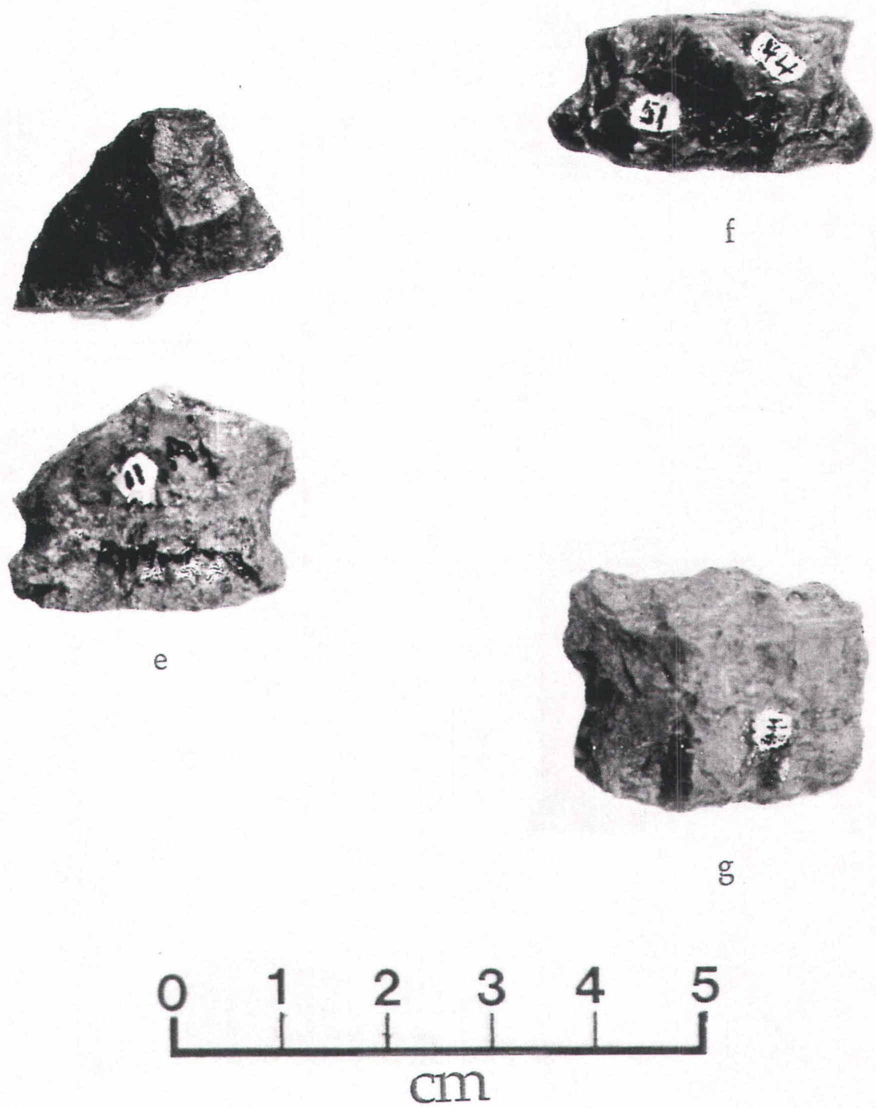
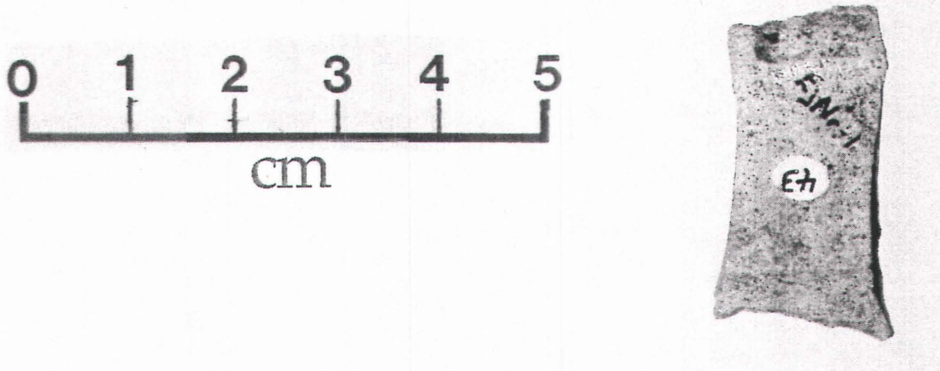
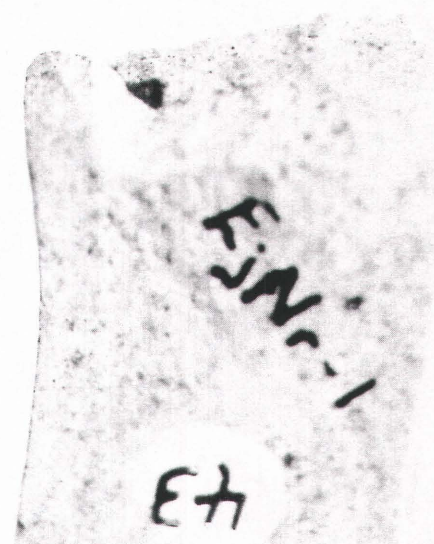


Figure 3 Photos of Large Pointed and/or Hafted Bifaces from the Sullivan site (continued)



Enlarged: 1cm = 2cm
Ventral view (note striae)



Enlarged: 1cm = 2cm
Dorsal view (note unifacial retouch)

Figure 4 Photo of use-striae on a siltstone uniface from the Sullivan site

Note wear polish blown-up below
on lower right corner of cobble tool.

Approximately 4X Actual size

Figure 5 Photo of use-striae on a large basalt cobble scraper from the Sullivan site

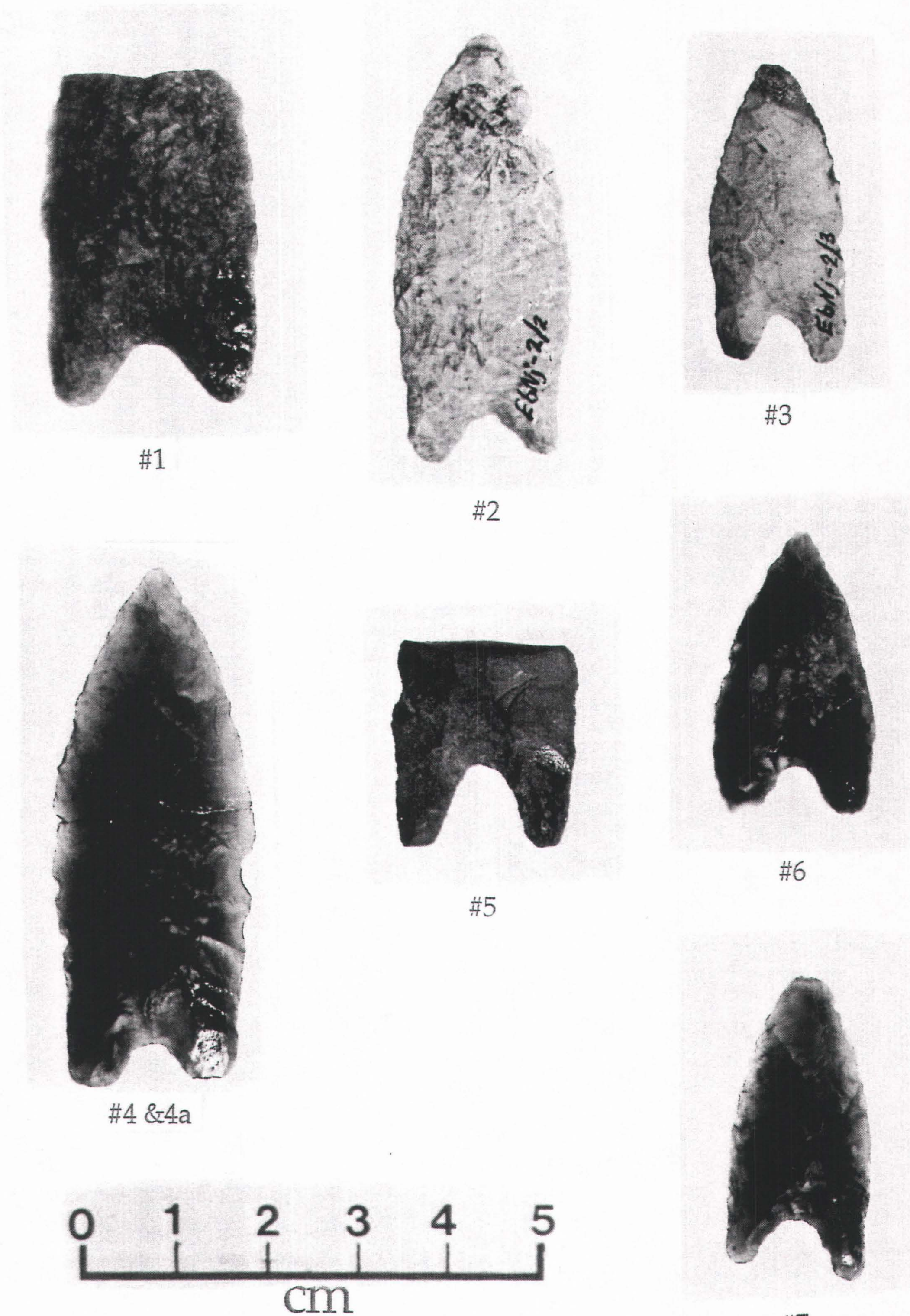


Figure 6 Photos of Points from the Big Kill site

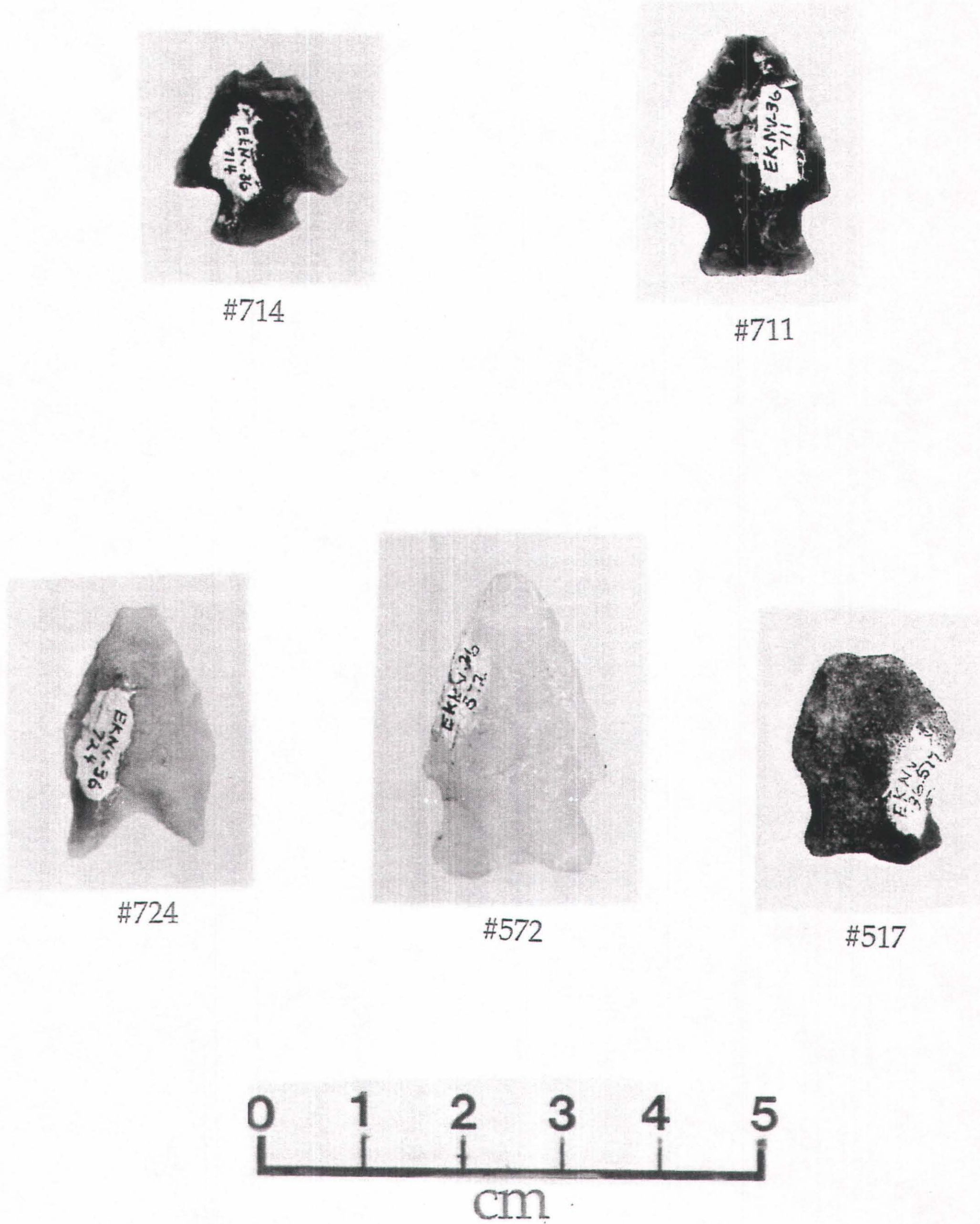


Figure 7 Photos of some points from the Billett site